Aalto University
School of Science

Degree Programme in Industrial Engineering and Management

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Business Model for Commercial Operations of a Single Engine Aircraft in Europe

Master’s Thesis

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Abstract of master's thesis

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Abstract

Objectives of the study

This thesis aims at developing a practical business model for operating Pilatus PC-12 aircraft in Europe. The underlying question is whether commercial operations with this aircraft can be profitable. The main goal is to answer a set of sub-questions derived from a business model framework covering financial, operational, technical and structural aspects. A secondary objective is to offer decision makers a better understanding of underlying decisions within the business aviation sector. This thesis, written in cooperation with Hendell Aviation, is eventually useful for the company, its partners and the whole industry.

Research data and methods

The main research data used in this thesis includes literature, market data, expert interview data and survey data. This comprehensive industry insight is used to both identify and analyse different business model options and choose the optimum model. Categorised interview data is analysed by both deductive and inductive content analysis methods that look for patterns, repetitive claims and relationship to theory. Interview data driven SWOT analysis serves as an aid to find the best model out of research data. Survey data is mainly analysed qualitatively, but also quantitative methods of ranking and scoring results are used. A separate business model evaluation frameworks is used to test the proposed business model.

Findings of the study

Thesis research suggests that the Pilatus PC-12 aircraft can be profitably operated in Europe. Furthermore, it can offer a cost advantage against existing air travel business models. Findings signal the aircraft is most suitable for a high aircraft utilisation rate model focusing operations outside of major hubs, preferably at easily accessible secondary airports with a high demand. Research also shows the aircraft is optimal for short air travel distances and that the most important customer value proposition is saved travel time. The study implies key resources to be aircraft maintenance, the right employees, experienced pilots and a robust business model.

Keywords Business models, business aviation, Pilatus PC-12, single engine aircraft, SET-IMC, EASA, turboprop, outsourcing, route network, value proposition, cost/revenue analysis, aircraft finance, pricing models, SWOT analysis.

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Sammandrag av diplomarbete

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Titel Affärsmodell för operation av ett enmotorigt flygplan i Europa

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Sammandrag

Syftet med diplomarbetet

Syftet med detta diplomarbete är att utveckla en affärsmodell för att operera Pilatus PC-12 flygplan i Europa. Diplomarbetet försöker även besvara frågan ifall kommersiell flygverksamhet med denna flygplansmodell kan vara lönsamt. Det huvudsakliga målet är att hitta svar på ekonomiska, operativa, tekniska och strukturella affärsval. Dessutom försöker arbetet erbjuda beslutsfattarna bättre förståelse om affärsluftfartssektorn. Arbetet är nyttigt för branschen samt för samarbetsbolaget Hendell Aviation och dess partners.

Forskningsdata och metoder

Diplomarbetet utnyttjar litteratur, marknads-, intervju- och undersökningsdata för att identifiera alternativa affärsmodeller och välja den optimala modellen. Kategoriserad intervjudata analyseras genom deduktiva och induktiva analysmetoder för att hitta relation till teori eller skapa ny teori. En ”SWOT” analys används för att hitta den bästa affärsmodellen för denna flygplansmodell. En skild online-undersökning analyserad med kvalitativa metoder förstärker forskningen. Den valda affärsmodellen är utvärderad med Michael Porters välkända ”five force” ramverk.

Forskningsresultat

Forskningen tyder på att en kommersiell Pilatus PC-12 operator lönsamt kan fungera i Europa. Dessutom kan denna affärsmodell bjuda på kostnadsfördelar jämfört med existerande modeller. Forskning visar att denna affärsmodell är lämpligast för ett högt årligt bruk av flygplanen med fokus utanför primära flygplatser. Flygplansmodellen är dessutom optimal för korta flygsträckor som sparar på resetid jämfört med landtransport. De viktigaste resurserna för att driva dessa flygoperationer innefattar ett starkt tekniskt underhåll, kunnig arbetskraft, erfarna piloter och en stark affärsmodell.

Nyckelord Affärsmodeller, affärsflyg, Pilatus PC-12, enmotoriga flygplan, SET-IMC, EASA, turbopropeller, utläggning, ruttnätverk, värde proposition, kostnads-/intäktsanalys, flygplans finansiering, prissättningsmodeller, ”SWOT” analys.

Foreword

First, I would like to thank my thesis instructor Mikael Lees and rest of the Hendell Aviation team for supporting and guiding me through my master's thesis. Mikael has an honourable work history within the field of business aviation and could therefore provide valuable information for this thesis. The Hendell Aviation team and especially Matti Auterinen provided me with connections to set up expert interviews that built up the basis for this thesis.

I am thankful to my thesis supervisor Professor Robin Gustafsson for giving me guidance and helping me with research technical questions during my work. Robin added enthusiasm towards research and writing this thesis.

I would also want to thank all the interviewees for their time and valuable insight provided for this thesis.

Special gratitude goes to my wife, parents and friends for supporting me through my studies towards a university degree.

Helsinki 02.04.2016

Jim Hiltunen

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Definitions

IMC	Instrument Meteorological Conditions refer to poor visibility conditions where pilots fly based on reference to instruments
SET-IMC	Flight operations with a single engine turboprop aircraft in Instrument Meteorological Conditions (IMC)
Turboprop	Turbine powered propeller driven aircraft

Abbreviations

AOC	Air Operator Certificate
CAT	Commercial Air Transport
CEO	Chief Executive Officer
DOC	Direct Operating Costs
EASA	European Aviation Safety Agency
EC	European Community
EU	European Union
FAA	Federal Aviation Authority
GBAA	German Business Aviation Association
GDP	Gross Domestic Product
GPS	Global Positioning System
GVA	Gross Value Added
IATA	International Air Transport Association
IBAC	International Business Aviation Council
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
ISA	International Standard Atmosphere
NBAA	National Business Aviation Association
NCO	Non-Commercial Operations
NCC	Non-Commercial operations with Complex motor-powered aircraft
Nm	Nautical mile
OEM	Original Equipment Manufacturer
SET	Single Engine Turbine
SPO	Special Operations
SWOT	Strengths, Opportunities, Weaknesses and Threats
UK	United Kingdom
US	United States
USD	United States Dollar
VLJ	Very Light Jet
WACC	Weighted Average Cost of Capital

1 Introduction

1.1 Background

This thesis focuses on developing a business model for operating a single engine aircraft, namely the Pilatus PC-12, commercially in Europe. The Pilatus PC-12 is the best-selling pressurized single-engine, turbine-powered aircraft in the world. This aircraft is used by private and corporate operators or regional airlines to transport passengers and cargo. There are two versions of the aircraft on the market; the "legacy" PC-12, manufactured between 1995 and early 2008; and the PC-12 NG ("Next Generation"), being the most current model on the market. The "Next Generation" model is faster and offers better performance than the "legacy" model and is referred to in this thesis unless otherwise specified. (George, 2014). Figure 1 (Pilatus, 2017) shows an example of the PC-12 aircraft and its interior.

Figure 1. Pilatus PC-12 aircraft and its interior. Source: Pilatus (2017), reprinted with permission.

Fortunately, an exceptional opportunity opened to conduct the research in cooperation with a Finnish air operator, Hendell Aviation, that operates PC-12 aircraft in Europe. Hendell Aviation was the first operator in Europe who received a commercial approval for operating single engine turbine powered aircraft, like the PC-12, in poor visibility weather where pilots fly based on reference to instruments (a.k.a. Instrument Meteorological Conditions). This type of approval is still not extensively adopted in Europe and only a few member states (e.g. Finland) allow it through an exemption. In addition to flight operations, Hendell Aviation engages in the operator consulting business and it is in their interest that commercial single engine operations amongst partners and even other operators become popular. One of the main challenges for PC-12 operators is the poor perception people have about the safety of a single engine aircraft. Once commercial operations with single engine aircraft become more common, both the travelling public and people within the industry will hopefully recognize these aircraft as a safe mean of travel. This thesis presents unique operator insight while developing a business model open to the public. This is an unusual opportunity since companies usually prefer to protect business model research.

The business model in this thesis is developed from the point of view of a pre-established commercial operator of Pilatus PC-12 aircraft. This prerequisite limit the research scope by leaving out non-commercial forms of operations that for example private, fractional ownership or management companies (introduced in section 2.2) are engaged in.

Prerequisite: A commercial Air Operator Certificate (AOC) serves as the basis for developing the business model.

The thesis subject is novel since similar research does not to exist yet. It is also very topical and relevant since in June 2016 the European Aviation Safety Authority (EASA), who regulates commercial flight activity within Europe, voted in favour of accepting commercial single engine operations in Instrument Meteorological Conditions (IMC) across all member states (refer to section 2.3). These new regulations were implemented in March 2017 (EASA, 2017). Strong growth in Europe is expected now that the new regulations are implemented, since commercial operations with single engine aircraft are popular in countries with mature aviation markets currently allowing this type of operation (e.g. US and Australia).

1.2 Objectives

Corporate executives see innovative business models as a major priority for business success. Osterwalder and Piguer (2010;14) describes a business model as the "rational of how an organisation creates, delivers and captures value". The objective of this research is to find an innovative and viable business model for operating Pilatus PC-12 aircraft commercially in Europe. The optimum business model aims at maximising revenue, profitability and cost-effectiveness. Since there is no single optimum business model, this thesis aims at finding one that might be successful through research of expert opinion. The aim is to cover financial, operational, technical and structural solutions related to an air operator business by exploring several perspectives and theories. The actual implementation and testing of the business model will be outside the scope of this thesis. Therefore, it remains open whether the suggested business model will be implemented or developed further.

In a highly dynamic market like the air transport industry it is important to analyse the market before making any investment decision. The second objective is to offer decision makers a better understanding of underlying business decisions within this industry segment. That is why the thesis puts great emphasis on explaining the underlying business drivers instead of only focusing on the research questions. The purpose is to present industry specific theory from existing literature that can be used when fine-tuning the proposed business model or when developing a new air operator business.

1.3 Research Questions

This thesis aims at answering several business model related questions presented in table 1. These research questions are developed in section 3.1 through the "business model canvas" framework.

Table 1. Thesis research questions related to Pilatus PC-12 operations in Europe.

Key Partners	• Which functions to outsourced?
Key Activities	• What route length and route structure to utilise? • What airport base and region to operate in? • What type of operations to conduct and with what fleet size?
Value proposition	• What should be the main value propositions?
Customer Relationship	• How should you interact with customers?
Customer Segment	• Which customer segment to target?
Key Resources	• What are the key resources?
Distribution Channel	• What are the best sales and marketing channels?
Cost Structure	• What do planned operations cost and how to cut cost?
Revenue Stream	• What are the revenue streams and how can they be increased?

Much of the focus is given to key activities since they play a huge role in the overall business model. In parallel with the research questions the underlying question whether commercial operations with a PC-12 aircraft can be economically profitable in Europe is examined.

1.4 Research Structure

The thesis begins with this introduction chapter and continues with an industry analysis in chapter 2. Chapter 3 presents the chosen frameworks for building a business model and the theoretical frameworks needed for specific industry analysis. Chapter 4 presents the actual research and resulting business model while chapter 5 evaluates the business model. Chapter 6 concludes and discusses the research. The thesis includes highlighted findings to help the reader spot relevant prerequisites, recommendations and conclusions as described below:

Prerequisite: Literature research or expert opinion points out to a certain requirement serving as a prerequisite for the business model

Recommendation: Literature research or expert opinion signals the importance of a matter when developing the business model

Conclusion: Points out the decided alternative for the business model based on thesis research

1.5 Research Methods

The market analysis in chapter 2 is based on literature review and findings will define a set of prerequisites limiting the scope of the business model. The chosen "*business model canvas"* framework presented in chapter 3 is compared with industry activities to form a basic structure for the different research areas. Additionally, a set of recommendations are derived from industry specific theory analysis. Chapter 4 includes a "*SWOT"* analysis based on a set of individual semi-structured qualitative expert interviews. The chapter continues with an analysis of the research questions based on interview findings and a quantitative survey, both aimed at aviation industry experts.

Interview data is mainly analysed by deductive (theory driven) content analysis and first the content is categorized in themes based on both the *"SWOT"* and *"business model canvas"* framework. The aim of this data analysis is to find and compare patterns, repetitive claims and relationships between interview data and existing theory and between separate interviews. A secondary method used to analyse interview data is inductive analysis where patterns are observed to form a general conclusion. To strengthen the interview analysis, the interviewees are categorized based on their expertise. This makes it easier to justify why some interviewee opinion might be more relevant and trustworthy regarding a specific subject. The survey tries to capture expert experience to back up the interview data. Survey data is mainly analysed qualitatively, but also quantitative methods of ranking and scoring results are used to some extent despite a low number of survey responses. Simple quantitative reasoning based on both market and interview data will support argumentation and give a better understanding of the market drivers. Each research section in chapter 4 starts with a brief introduction to the applied research method. The business model decision is evaluated in chapter 5 with Porter's *"Five Force"* framework. Below is a summary on the purpose of each research chapter:

- Chapter 2 analyses the market and outlines the prerequisites for the business model.
- Chapter 3 acts as a theoretical framework and provides recommendations for the business model.
- Chapter 4 defines the final business model and highlights significant findings.
- Chapter 5 presents and evaluates the chosen business model.
- Chapter 6 presents limitations of the study and recommends further research.

2 Market Analysis

This chapter presents an overview of the present market situation for an air transport business model with PC-12 aircraft. Another aim is to identify possible prerequisites induced by the market affecting the business model. Topics listed below are examined in separate sections:

- Section 2.1 *"Business Aviation Sector"* presents the segment that PC-12 aircraft belong to;
- Section 2.2 *"Business Aviation Categories"* identifies six different categories within the sector;
- Section 2.3 *"Regulatory Scene"* defines the directive framework for PC-12 operations;
- Section 2.4 *"Competing Companies"* introduces potential competitors for the proposed business model;
- Section 2.5 *"Rival Aircraft"* identifies the aircraft that are competing with the PC-12; and
- Section 2.6 *"Geographical Distribution of Flight Activity"* presents how business aviation is spread across Europe.

The global air transport industry is characterized by intense competition; it is sensitive to market disturbances, and it has been cyclical in nature. The market challenges are high fixed costs and capital intensive investments in long-term assets. Therefore, exit barriers are high - which usually leads to price war and oversupply - while entry barriers have been lowered due to increased market liberalization. Historically, the profitability figures have been low despite high growth rates. Low profit margins are particularly true for air transport operators since they are caught between airports and manufacturers that can generate high profits on operators' expense due to lower competition. Airports can be seen to represent an oligopolistic market structure. The global financial crisis that began in 2007 became a challenge for the industry that is particularly sensitive to the overall economic performance and it had problems to grow for two subsequent years. Negative effects often impact the industry immediately while recovery seems to be much slower. (Wittmer et al., 2011).

2.1 Business Aviation Sector

In this thesis, the Pilatus PC-12 is categorised as an aircraft competing in the European business aviation segment, although some elements of the proposed business model may directly compete with major airlines. The International Civil Aviation Organisation (ICAO, 2016) recognises three kinds of operations, namely commercial air transport, general aviation and aerial work. In their categorization business aviation falls somewhere between commercial air transport and general aviation. Oxford Economies (2012) explain the term "business aviation" as covering a wide variety of services ranging from operators offering charter services to in-house airlines operated by large firms. The German Business Aviation Association (GBAA) only recognises non-scheduled traffic as business aviation, while Eurocontrol defines business aviation based on a list of specific aircraft types, which includes the PC-12 aircraft (Linz et al. 2011). For simplicity, the term "business aviation" is used in this thesis whether referring to charter, scheduled or other forms of operations.

Business Aviation accounts for nearly 7% of all flights in Europe, adding up to roughly 650 000 flights in 2015 (Eurocontrol, 2016). The business aviation sector has grown a lot after air travel liberalisation but the sector has not been studied in a large degree. A paper published in the journal of Transport Geography argues that this is due to its "unique spatial geography" making business aviation largely invisible and due to "client confidentiality and security" (Budd and Graham, 2009; 291). The European Business Aviation Association (EBAA) has during the last decade collected data and published statistic on business aviation movements in Europe. Per the 2015 EBAA annual review, the business aviation sector movements saw only a marginal growth of 0.7% in Europe in the year 2015 and before that business aviation declined for some years (EBAA, 2015). Interestingly, international business aviation flights have increased to and from Europe by 40 percent between 2005 and 2015 while internal departures have declined by 2.7 percent (EBAA, 2016). Overcapacity seems to be an issue in the European Business Aviation market year after year. Overall in the last 10 years the business aviation fleet has grown at a higher rate than the traffic, a situation that may jeopardise the sustainability of margins. Figure 2 (EBAA, 2015) below shows how the European Business aviation fleet continued growing even during years following the financial crisis when traffic declined.

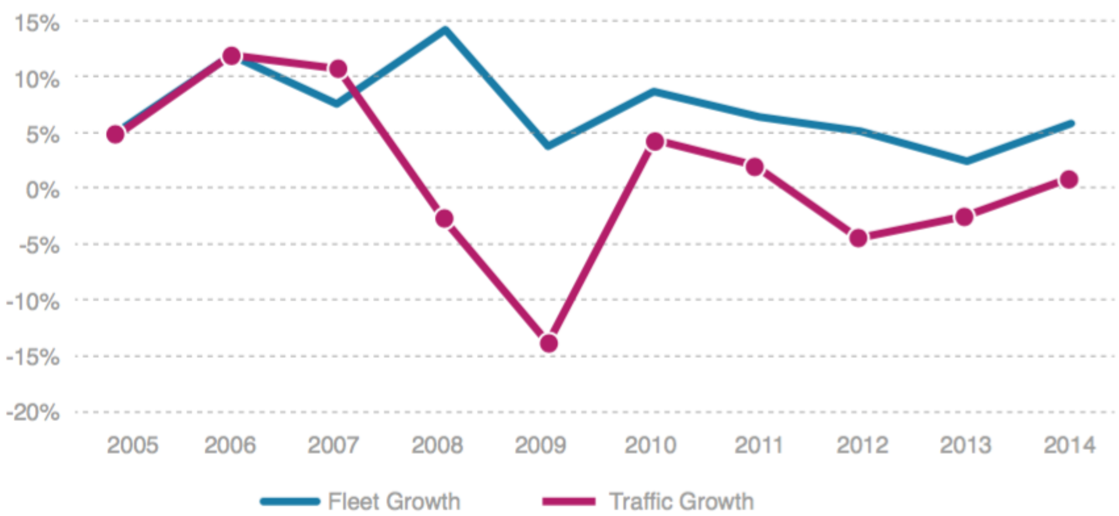

Figure 2. Business aviation fleet and traffic growth in Europe 2005-2014. Source: EBAA (2015), reprinted with permission.

Business aviation in Europe had around 700 operators in 2006 based on Eurocontrol statistics, with just six of these operators controlling over 1% of the market (Marsh, 2006). Same year statistics show that nearly 85% of business aviation operators had less than 5 aircraft in their fleet and 39% had just one aircraft (Ibid.). EBAA statistics indicate that the operator count has increased to over 800[1] with a combined fleet comprising nearly

[1] Figure includes both commercial and non-commercial operators.

4000 aircraft (Ebaa.org, 2016). This means that the average fleet size is now around 5 aircraft per operator (Ibid.). Small operators are still making up most of the industry, which bring local knowledge. However, economics of scale and spare resources are not utilised to their full potential. Yves Roch (2016), the chief executive at Fly 7, who operates private owned PC-12 aircraft in Switzerland, argues that some competitors in the market are growing very big, which signals that the market is changing. The clear majority of business aircraft in Europe are owned and/or operated by governments and companies; only around 3 percent are both privately owned and operated (Ebaa.org, 2016).

The European business aviation sector connects 103,000 city-pairs of which 96% are not served by scheduled carriers (Ebaa.org, 2016). Germany, France and the UK represent around 63% of the European business aviation market in terms of Gross Value Added (GVA) (Booz Allan Hamilton Inc., 2016). An influential report commissioned by the European Business Aviation Association claims business aviation is “a prime enabler for regional economic development" (Booz Allen Hamilton Inc., 2016; 7). The industry adds over 27 billion euros in GVA and employs more than 371,000 people directly or indirectly in Europe (Ibid.).

WingX Advance, a company publishing business aviation trend statistics, estimates that business aviation in Europe had almost 780 000 customers in the year 2015 (EBAA, 2016). The demand does not only consist of business travellers, since leisure travellers are also seeking for a wide range of destinations with a flexible schedule and a high-end service. However, business passengers are willing to pay more for the service. Lee et al. (2007) claims business men in the US were already ten years ago willing to pay up to 1800 USD premium per trip for the benefits of private flying. According to a US study, 22% of business aviation users are top executives, 50% middle managers and 20% technicians (Krane and Orkis, 2009). An Eurocontrol study estimates that nearly 90% of the total value of time saved comes from executive travel, since their time can be valued at a greater price as salaries are higher (Booz Allan Hamilton Inc., 2016). The same research revealed that 59% of private companies operating business aircraft have less than 500 employees, while 7 in 10 have fewer than 1000 employees. Archer et al. (2012) claims in a research that air taxi operations increase with higher income level as these individuals place greater value on their time. According to the study, this segment begins at individuals earning over 100 000 USD per year. Market analysis also shows that the air transport customers can be defined as a group of people with similar preference and buying behaviour (Wittmer et al., 2011). In the past large corporations where principally the only users of business aviation. Today an increasing amount of small and medium-sized firms use business aviation as lower-cost light jets and turboprop aircraft introduce benefits of private business travel at a lower price point.

Linz et al. (2011) conducted a survey analysis about the outlook of the business aviation sector in 2025 and concluded that customers will increasingly demand easy point-to-point transportation without wasting time. The analysis forecasts growth in the sector to mainly arise from long-haul international flights to emerging markets. Oxford Economics (2012) conducted a study on Business Aviation in Europe and concluded that business aviation accounts for 9% of revenues from business related trips compared to its 7% share of all European flights. More significantly, each passenger flown is estimated to generate the same contribution to GDP as nine passengers on scheduled flights (Ibid.).

2.2 Business Aviation Categories

Wittmer et al. (2011) divides business aviation into corporate aviation and air taxi services. A more detailed definition, presented by the International Business Aviation Council (IBAC, 2016), divides the existing business aviation companies in Europe into four segments based on their business structure, namely *commercial, fractional ownership, corporate and owner operated*. The European Business Aviation Association adds a fifth category of aircraft operated by a *fleet management* company on behalf of the owner (Ebaa.org, 2016). There also exists a black market considered in the categorization below that often goes uncategorized. The six business aviation subcategories considered in this thesis are:

- Commercial;
- Fractional;
- Corporate;
- Owner operated;
- Fleet management; and
- Black market.

These sub-divisions are analysed as competitors for a PC-12 business model even though this thesis only focuses on developing a business model belonging to the first listed category. In the non-commercial business aviation categories, the PC-12 is already the most active aircraft in Europe (Koe, 2016).

Commercial operations with business aircraft mainly consist of air charter operators renting the entire aircraft to companies or individuals. Commercial operations are carried out by companies with an Air Operator Certificate (AOC), which in Europe is identical to a certificate held by a major airline (Ebaa.org, 2016). The typical air charter service is described in an Oxford Economics (2012: 8) article as a service “offering clients a point-to-point multi leg trip in a similar fashion as hiring a car and a driver on the ground”. Some air taxi companies even serve as feeders for first class passengers traveling with larger airline carriers (Wittmer et al., 2016). One fast growing business model within commercial operations is companies offering loyalty programmes for customers who can fly on-demand with a fixed price per hour. Linz et al. (2016) argues in a study on business aviation that the air charter model is most economic for clients flying up to 100 hours annually with an average of four passengers. One charter aircraft is typically operated between 600 and 1200 hours annually and 4.7 flights on an average per week (Marsh, 2006).

Fractional ownership means that individuals or companies purchase a partial share in an aircraft operated by a fractional ownership company. The fractional owners can then use any aircraft in the fleet on demand for a certain number of flying hours yearly (Ebaa.org, 2016). Oxford Economics (2012: 8) defines fractional ownership as “a scheme whereby a number of separate parties jointly own an aircraft and split the available flying time and associated costs between them”. Owners therefore save money on overhead costs as the aircraft is more frequently used. According to Linz et al. (2016), the fractional ownership model can be viable for users that fly between 50 and 400 flight hours per year. Typical fractional ownership models use 800 hours as their aircrafts yearly utilization rate, this means that 50 hours requires a sixteenth share of one aircraft (Ibid.).

Corporate operators own or lease an aircraft for serving the company's own travel needs. This is for example a good way for manufacturing companies to link production sites with their headquarters. Lukas Wickart (2016), the former head of strategy at Surf Air US, noted in an interview that corporations in Europe are less willing to fund private aircraft expenditures than US corporations. One corporate aircraft is typically operated between 200 and 600 hours annually and 2 flights on an average per week (Marsh, 2006).

Owner operated aircraft are both held and operated by a private owner. Owner operated aircraft have traditionally been a popular category in Europe, however, owners are increasingly using fleet management companies to operate their aircraft. Linz et al. (2011) states that the ownership model can be advantageous for users that fly over 400 hours per year. However, owner operated aircraft are typically flown between 150 and 250 hours annually (Marsh, 2006).

Fleet management companies operate aircraft on behalf of their corporate or private owners either privately or commercially. Besides actual operations, fleet management companies normally handle all regulatory control, dispatch, maintenance and crew training functions and more (Ebaa.org, 2016).

The unofficial black market consisting of operators conducting commercial flights without a commercial license (AOC). These illegal flights were estimated to account for 14% of the whole European Business aviation market in 2014 (EBAA, 2014). Another estimate by the British Business and General Aviation Association (BBGA) states that around 7% of charter flights are illegally operated without an AOC (Fly Corporate, 2015).

2.3 Regulatory Scene

Historically, the aviation industry has been heavily regulated and restricted since it plays an important role in the safety and security of the travelling public. Heavy regulations also add to the cost of doing business and if regulations are poorly designed, it may create expenses without adding to safety. Aviation has both national and international regulating authorities. The International Civil Aviation Organization (ICAO) is the most important regulator worldwide providing standards and recommended practices for safety and security regulations that signatory states implement in their national regulation. Additionally, to standardise air traffic in terms of flight paths and pricing the International Air Transport Association (IATA) has been set up and consists of airline representatives. However, small air taxi charters and some low-cost airlines have chosen not to join IATA. Since the late 1970s until now regulations concerning market access, pricing, route structure and service frequencies has been deregulated worldwide. (Budd and Graham, 2009).

Following the Chicago Convention in 1944, there is nine freedoms of the air, including, the right to fly across foreign territories without landing and the right to transport passengers and cargo between contracting states or within contracting states (Wittmer et al. 2011). The Chicago Convention also laid down restrictions on cabotage, which refers to an aircraft registered outside of a country operating commercial flights within that country (Twidell, 2016). Most countries in the world do not permit cabotage, however, the

European Union (EU) is a notable exception to this global restriction. Commercial air operators can fly passengers freely between EU member states or domestically within other EU member states (Cento, 2009). This European single market has increased air travel, created jobs and brought down entry barriers to a high degree.

The European Aviation Safety Agency (EASA) is a special organisation of the European Community (EC) and acts as the regulating authority in Europe. For non-commercial operations EASA has a categorization based on non-complex or complex aircraft. An aircraft is considered non-complex if it weighs less than 5700kg, has less than 19 seats, and is not equipped with more than one turbojet or turboprop engine (EASA, 2008). Therefore, the PC-12 falls into the category of non-complex operations which streamlines regulations for private and corporate operators. However, since this later categorization is not considered for commercial operations, higher regulatory requirements must be met when operating the Pilatus PC-12 aircraft commercially. The regulations that apply to commercially operated business aviation aircraft are perceived high in the European regulatory scene. Matti Auterinen (2016), the accountable manager of Hendell Aviation, stated in an interview that EASA regulations are demanding since they are based on heavier airline operations. Auterinen argues that even though regulations in the US are much lighter for commercial business aviation aircraft the safety is not threatened. He further states that “once regulations are a bit lighter, scarce resources are released to more important tasks”.

Since 1998 in the US single-engine turboprop aircraft such as the Pilatus PC-12 have been allowed to conduct commercial passenger or cargo flights at night and in Instrument Metrological Conditions (IMC) (Fly Corporate, 2016a). Australia, South Africa and New Zealand have allowed these operations since the mid-1990s (Ibid.). In most European countries, the single-engine turboprop aircraft were until recently only permitted to fly by night and/or in IMC conditions in non-commercial operations. The matter divided opinions due to the risk of an engine failure. However, statistics show the turboprop engine reliability on PC-12 aircraft is such that a high level of safety is guaranteed (Ibid.). Finally, in March 2017 EASA approved commercial operations at night and in IMC conditions with single-engine turboprop aircraft across all member states (EASA, 2017). Before these operations were only allowed through an exemption in some of the member states, including Finland, France, Greece, Norway, Spain and Sweden (EASA, 2014a).

ICAO Annex 6 Part I Chapter 5 provides standards and recommended practices for Commercial Air Transport (CAT) SET-IMC operations, which the EU has now applied through new EASA regulations. It was originally not permitted in the EU regulations due to the risk involved in the level of power plant reliability that existed when ICAO rules were published in 2005. New statistics show that SET aircraft safety rates are in the same range as for twin turboprop aircraft with a fatal accident rate close to 4 per one million flight hours. The adaption of new regulations started in 2014 when EASA released a notice of proposed amendments to regulations concerning CAT operations at night or in IMC using single-engine turbine aeroplanes with the aim to allow and standardise related regulations in all member states. (EASA, 2014).

The EASA (2014) "NPA 2014-18" regulatory document listed the following issues recognised with not accepting CAT SET-IMC flights:

- ICAO compliance issue – EASA not aligned with ICAO standards and recommended practices;
- Environmental issue – Regulation does not promote the use of modern SET airplanes with lower emissions;
- Social issue – Prevents the opening of new routes to destinations in remote areas that could be served with SET aircraft; and
- Economic issue – Regulation prevents the development of new routes to promote business in remote communities that could be served with SET aircraft.

In June 2016 EASA commission voted in favour of EASA Opinion 06/2015, which contains the regulatory framework for allowing these operations (Registeranaircraft.com, 2016). As expected these regulations were implemented in March 2017 (EASA, 2017). The proposed regulatory amendments are aligned with the current ICAO provision for SET-IMC operations. Additionally, a specific approval is required for SET-IMC operations and include requirements for:

- minimum aircraft equipment;
- an engine monitoring programme;
- crew training and checking; and
- conducting a landing site review.

The new SET-IMC regulations will mainly affect operations with the following aircraft types; TBM700/850, C208 and PC-12, since these represent 78% of the single-engine aeroplanes operated in Europe. (EASA, 2014a).

Archer et al. (2012) argues in their analysis on air taxi operations that commercial business aviation operators should poses all-weather capabilities since delays related to poor visibility are unacceptable. In interviews conducted by Eurocontrol on several European operator's, participants noted that flights in visual meteorological conditions (VMC) are not worthwhile due to unreliable service in poor weather and at night (Marsh, 2006). In line with literature and expert opinion (Auterinen, 2016; Lees, 2016) it can be concluded that operations in instrument meteorological conditions (IMC) is a perquisite for viable commercial business aviation operations. Additionally, the most important customer promise of air travel - which is getting from point A to point B - can't be assured unless operating in instrument meteorological conditions (Lees, 2016).

Prerequisite: A commercial PC-12 business model needs to possess all weather capability and essentially a SET-IMC certificate.

2.4 Competing Companies

Table 2 lists the eight largest business aviation operators by fleet in Europe year 2006 based on an Eurocontrol study conducted by David March (2006). Year 2016 figures compiled in the same table and retrieved from each operator's website reveal that six of the eight largest operators in 2006 where still operating in 2016 and only two of the operators (NetJets and TAG Aviation) had grown significantly. Table 3 indicates how some new competitors that were not part of the eight largest operators in 2006 have grown rapidly in the recent years. Most of these new players have global presence and it is worth to note that their approximate fleet sizes presented in table 3 represent global figures retrieved from each operator's website.

Table 2. Eight largest business aviation operators in Europe 2006 and their fleet size in 2016. Note: Compiled data from March (2016) and operator websites.

Company	Operations	# of Aircraft (2006)	# of Aircraft (2016)
NetJets	Charter, Fractional	91	130
Grupo Gestair	Charter, Fleet Mgt.	31	27
Jetalliance Flugetriebs	Charter, Fleet Mgt.	28	Bankrupt
London Executive Aviation[1]	Charter, Fleet Mgt.	22	22
TAG Aviation	Charter, Fleet Mgt.	20	50+
Zimex Aviation	Charter	20	20
Aero Services Executive	Charter, Fleet Mgt.	16	Ceased
DC Aviation	Corporate, Charter, Fleet Mgt.	14	17
[1]*London Executive Aviation became part of Luxaviation Group in 2014 and is now called Luxavaition UK*			

Table 3. Four rapidly growing European business aviation operators and their approximate fleet size in 2016. Note: Compiled data from operator websites.

Company	Operations	Established in	# of Aircraft (2016)
Luxaviation Group[1]	Charter, Fleet Mgmt.	2009	250+
Gama Aviation	Charter, Fleet Mgmt.	1983	140+
Vista Jet	Charter, Fleet Mgmt.	2004	70+
Air-Hamburg	Charter, Fleet Mgmt.	1997	20+
[1]*Luxaviation Group consisting of former operators including, ExecuJet, London Executive Aviation, Masterjet, Abelage, Unijet and FairJets.*			

The large operators presented in table 2 and 3 mainly operate luxurious jet aircraft and it can be interpreted that the high-end customers are well served since they have many options ranging from full or fractional ownership to charter. Therefore, it may be advised that a PC-12 business model would not be aimed at the wealthiest user segment. Customer segments to target are further examined through expert interview analysis in section 4.5. Mikael Lees (2016), the continuous airworthiness manager of Hendell Aviation, noted in an interview that some of the larger business aviation companies may not pose a real threat to the business model. Instead he thinks that smaller operators like Blink and Jetfly may serve as main competitors for a PC-12 business model in Europe.

2.5 Rival Aircraft

Europe's business aircraft fleet is one of the world's youngest, since around 50 percent of aircraft are less than 10 years old (EBAA, 2015). As per Figure 3 (EBAA, 2015), the fastest growing segments in terms of aircraft type has been Very Light Jets (VLJ) and ultra long range aircraft, while turboprops have slightly declined over the past 10 years. New engine and airframe technology allows manufacturers to make less expensive light jet aircraft that reduce operational cost and can land on shorter runways than traditional jet aircraft. These form a potential threat to any PC-12 business. Competing aircraft from the VLJ segment include for example the Eclipse 500, the Cessna Mustang and the Embraer Phenom 100 (Marsh, 2006). Lees (2016) noted in an interview that "the high expectations for the VLJ market - which started roughly a decade ago - never really materialized and the VLJ is currently a niche product". Despite the small decline amongst all turboprops, single engine turboprops are getting more popular and turboprop aircraft still makes up the largest aircraft segment in business aviation when comparing yearly departure rates. Koe (2016), the managing director at Wing X Advance, notes in an online article that the demand for private flights on single engine aircraft like the PC-12 has grown at an average annual rate of 16 percent.

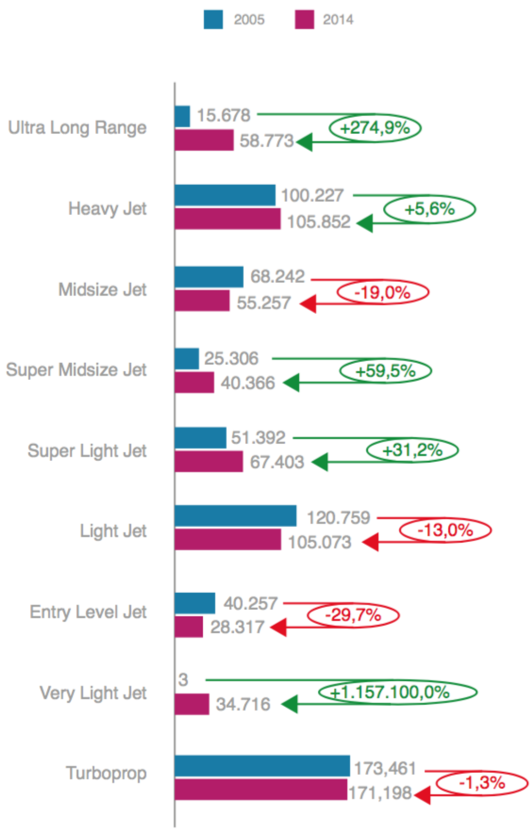

Figure 3. Business aviation yearly departures and growth rates per aircraft segment between 2005 and 2014. Source: EBAA (2015)*, reprinted with permission.*

Industry experts recognize the TBM line, the Piper M line and the range of King Air turbo propeller aircraft as the nearest rival aircraft for the PC-12 (Cordova, 2016; Lees, 2016;

Korkelainen, 2016). VLJ aircraft competing in the same price class include the Cessna Citation Mustang (Cordova, 2016), while jet aircraft competing in cabin size and comfort are for example the larger Cessna Citation Jets (Lees, 2016). For cargo operations, the Cessna Caravan can also be listed as a main competitor aircraft for the PC-12 (Korkelainen, 2016; Cordova, 2016). Piston engine aircraft offers a cost competitive alternative for air taxi operations. However, Archer et al. (2012) argues that passengers are not willing to wear headsets or oxygen masks during air transport which limits the maximum usable altitude. Piston engine aircraft are mainly used at low altitudes for short routes and in good weather. Average hourly rates for all turboprop aircraft in Europe (including twin engine) was 4101 euros per hour in the first quarter of 2016 (WingX Advance, 2016). The hourly price for a light jet was 4192 euros and a piston engine aircraft 3297 euros during the same period (Ibid.).

Table 4. Comparison of aircraft approximate operating costs and characteristics. Note: Compiled data from Conklin & de Decker (2010; 2016), bcdigital.com (2016) and manufacturer websites.

Aircraft Type	Purchase price[1]	Seats[2]	Cruising speed	Variable cost[1]	Variable cost per NM per seat	Maximum range
PC-12 NG	4.59 m€	9	250 kts	690 €/h	0.31 €	1845 Nm
Piper M500	1.88 m€	4	250 kts	482 €/h	0.48 €	1000 Nm
TBM 900	3.65 m€	6	282 kts	665 €/h	0.39 €	1514 Nm
Cessna Caravan	1.83 m€	8	157 kts	483 €/h	0.38 €	1070 Nm
King Air 250	5.63 m€	7	287 kts	1117 €/h	0.56 €	1720 Nm
Eclipse 550	2.81 m€	4	307 kts	696 €/h	0.57 €	1040 Nm
Phenom 100	3.91 m€	6	324 kts	879 €/h	0.45 €	1178 Nm
Citation Mustang	3.15 m€	5	310 kts	789 €/h	0.51 €	1141 Nm
Cessna Citation M2	4,23 m€	5	361 kts	1054 €/h	0.58 €	1550 Nm
[1]*Euro/dollar conversion rate 1.065 used (m = million; h = hour).* [2]*Commuter version.*						

Archer et al. (2012) concluded in their research that the PC-12, Piper Meridian (M500) and the TBM 850 (earlier version of the TBM 900) are the three best options for air taxi operations due to their low operating costs. Table 4 shows that the PC-12 has the lowest variable cost per Nautical mile (Nm) per passenger when compared to common rival aircraft from both the turboprop and jet segment. At the same time the PC-12 is one of the more expensive aircraft in its class, with a purchase price in the same price range as light jet aircraft. Therefore, the PC-12 is most suitable for a business model utilizing the aircraft at a high yearly rate to lower the capital cost per hour. Transporting a high number of passengers lowers the capital cost per passenger seat. In section 4.8 the capital cost is studied in more detail and the overhead costs are added to the comparison for further analysis of the total operating costs.

2.6 Geographical Distribution of Flight Activity

According to Eurocontrol statistics, business aviation was already ten years ago mainly concentrated in six European states; Germany, France, UK, Italy, Spain and Switzerland, together accounting for 69% of all departures (Marsh, 2006). Recent data compiled in table 5 shows the distribution of non-scheduled business aviation flights has stayed largely unchanged with the same six countries still in the lead. The same statistics show that these countries all have a relatively high percentage (between 56 and 75 percent) of small jet and turboprop aircraft operations, indicating that there is a pre-existing a market for aircraft like the PC-12. Additionally, a fair proportion of these flights (between 40 and 61 percent) are operated commercially. In 2010 one-third of all business aviation flights in these six countries were domestic and two-thirds international flights (Linz et al., 2011). These countries all have a relatively high Gross Domestic Product (GDP) and a study conducted by Cento (2009) argues that a higher GDP tend to impact air transport price levels positively.

Table 5. Non-scheduled business aviation flights in Europe operated under Instrument Flight Rules (IFR). Note: Compiled data from WingX Advance (2016).

Combined data for Q3/2015, Q4/2015 & Q1/2016	Business aircraft departures	Average growth rate	Percentage of commercial (AOC) operations	Percentage of small jets or propeller aircraft
France	87.845	+ 0.1 %	42 %	67 %
Germany	69.897	- 0.3 %	40 %	75 %
UK	69.485	+ 0.1 %	54 %	59 %
Italy	42.930	-2.5 %	48 %	56 %
Switzerland	33.550	- 1.1 %	46 %	57 %
Spain	29.999	+ 1.0 %	61 %	60 %
Turkey	17.834	- 8.7 %	31 %	27 %
Norway	16.172	- 4.1 %	89 %	90 %
Austria	14.389	- 2.0 %	50 %	64 %
Sweden	14.389	+ 5.3 %	46 %	83 %
Russia	13.667	- 21.1 %	60 %	11 %
Greece	10.039	No data	50 %	43 %
Netherlands	9.065	+ 1.6 %	42 %	65 %
Belgium	8.784	+ 0.8 %	53 %	69 %
Poland	7.540	- 1.2 %	31 %	85 %
Czech Republic	6.594	-2.9%	51 %	72 %
Finland	6.464	- 1.4 %	38 %	80 %
Denmark	5.460	- 2.0 %	47 %	60 %
Ireland	4.962	+ 2.7 %	45 %	44 %
Portugal	4.504	- 1.0 %	52 %	44 %
Ukraine	4.372	- 26.9 %	44 %	44 %
Croatia	3.729	- 3.0 %	41 %	75 %
Serbia & Montenegro	3.157	-1.0 %	24 %	79 %
Luxembourg	3.055	No data	38 %	79 %
Romania	2.791	- 3.6 %	37 %	71 %
Slovakia	2.610	+1.1 %	56 %	73 %
Hungary	2.288	+ 10.9 %	46 %	68 %
Cyprus	2.347	+ 21.3 %	42 %	22 %
Canary Island	2.015	No data	67 %	57 %
Bulgaria	1.657	- 14.5 %	62 %	45 %

Le Bourget airport in Paris is the busiest business aviation airport in Europe, followed by Geneva Cointrin, Nice, London Luton and Moscow Vnukovo (EBAA, 2015). Figure 4 (EBAA, 2015) illustrates how the top 10 business aviation airports in Europe have developed over recent years.

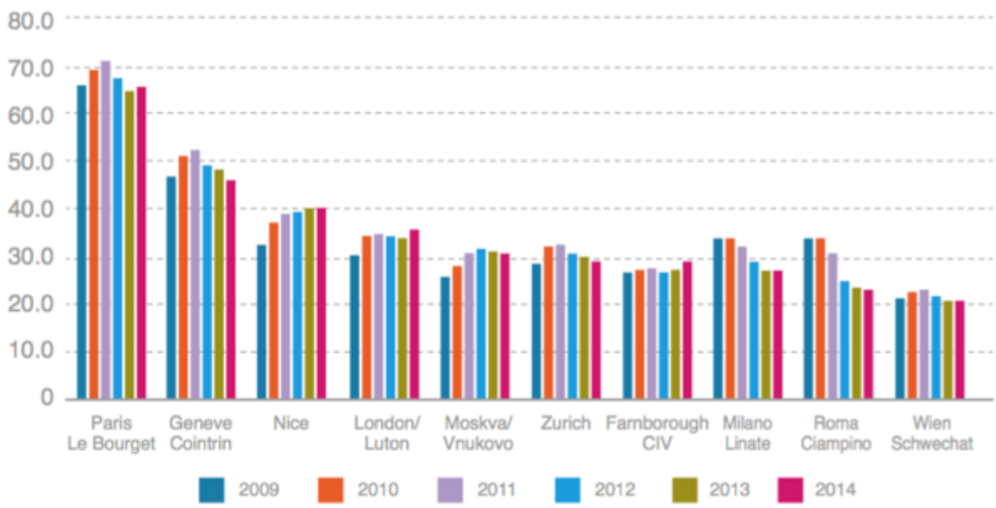

Figure 4. Top 10 airports by average daily departures of business flights. Source: *EBAA (2015), reprinted with permission.*

Figure 5 (Oxford Economics, 2012) presents the top 500 busiest business aviation routes in Europe, revealing active routes in France, UK, Italy, Switzerland and between Moscow and central Europe. The route lengths are obviously longer to and from Moscow when compared to traffic within central and western Europe.

Figure 5. Europe's 500 busiest business aviation routes. Source: Oxford Economics (2012), reprinted with permission.

There are several aspects that may influence the future geographical distribution of flight activity in Europe. One market disruptor is high speed trains which are forecasted to reduce European flight growth by 0.5% for the upcoming 7 years. High speed trains may have a significant impact locally and Eurocontrol forecasts the effects to be highest in France, Turkey and Spain. (Eurocontrol, 2016).

2.7 Chapter Conclusion

Market analysis shows that the European business aviation sector is characterised by overcapacity leading to intense price competition. The regulatory scene appears to shed light on commercial single-engine operations in Europe. However, any commercial business model in this sector needs to be cost effective when competing against expanding companies and strong substitutes, plus flexible when fighting against cyclical market disturbances. The third prerequisite presented below serves as a conclusion for this market analysis chapter.

Prerequisite: A commercial PC-12 business model needs to be cost effective to be competitive against strong rivals and substitutes (e.g. trains, airlines and cars).

3 Business Model Framework and Context

This chapter introduces the basic framework adopted to build up a comprehensive business model and familiarizes the reader with industry specific theory needed to develop the business model. The industry specific theory, obtained through a literature review, is analysed to form recommendations that are used when developing the business model. Chapter 4 applies theory presented in this chapter for the deductive (theory driven) interview and survey analysis or reflects research outcome against theory in this chapter (inductive approach).

3.1 Business Model Framework

For the outcome of this thesis it is essential to understand what a business model is and what they are useful for. Corporate executives see innovative business models as a major priority and often argue that business model innovation is here to stay (Ricart and Casadesus-Masanell, 2011). Osterwalder and Pigneur (2010) describes a business model as the “rational of how an organization creates, delivers and captures value”. Tim Kastelle (2012) argues in his online academic paper that all business models are characterized by the question “how do we sustainably deliver value to our customer?”. He further claims business models serve as role models that used to “ensure that you have strategic fit across all activities”. To communicate a business model, it is important to have a simple, understandable and relevant framework.

Verna Allee (2008), an expert in new business models, describes a business model as a value network or essentially a web of relationships generating value. The core in the "value network" framework she developed is that value creation is about how tangible and intangible assets form relationships to generate and capture value (Allee, 2008). Another well-known model is Henry Cherbrough’s “business model innovation” also suggesting that a business model shall both create and capture value (Chesbrough, 2006). The primary purpose of his model is to develop a value proposition, identify a market segment, define the value chain, specify the way of generating revenue, express the firms position in the value network and create a strategy to gain a competitive advantage (Chesbrough, 2006). A third well-established business model framework is the “Strategy Diamond” developed by Hambrick and Fredrickson (2005). This model explains how the various elements of strategy can be linked together to form a comprehensive business model. The major elements in the model are; “arenas - where to be active”, “vehicles - how to get there”, “differentiation - how to win”, “staging - what will be the speed and sequence of moves”; and these elements link together by a fifth element of "economic value" (Hambrick and Fredrickson, 2005). A fourth frame-work developed by Mark Johnson (2008) breaks up the business model into four elements; “revenue model, cost structure, margin model and resource velocity”. The aim of this framework is to answer why someone prefers to buy from you, how you earn money selling it and what are the important factors you needed to succeed (Johnson, 2008). Finally, one of the most used frameworks for describing a business model is the “business model canvas” originally proposed by Alexander Osterwalder in his PhD (Kastelle, 2012). The name originates from the idea that the business model can easily be reproduced as a visual chart containing nine elements as shown in figure 6 below (Strategyzer.com, 2016).

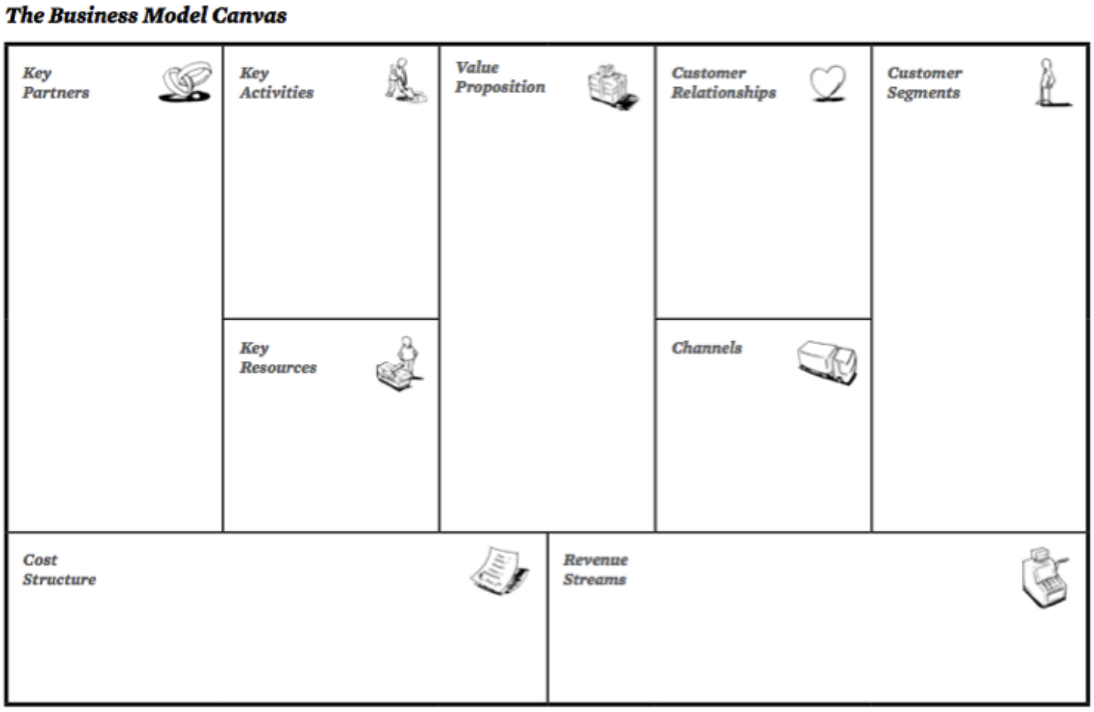

Figure 6. Business Model Canvas. Source: Strategyzer.com (2016), reprinted with permission.

The nine elements ultimately lead to the following simple questions (DIY, 2016):

1. Key Partners - Who will help you?
2. Key Activities - How do you do it?
3. Value Proposition - What do you do?
4. Customer Relationship - How do you interact?
5. Customer Segment - Who do you help?
6. Key Resources - What do you need?
7. Distribution Channel - How do you reach them?
8. Cost Structure - What will it cost?
9. Revenue Stream - How much will you make?

The business model canvas has gained popularity because it is simple and easy to understand. This business model framework easily reflects to the business aviation industry and all relevant questions for this thesis can be divided in one of the nine elements presented in the canvas (refer to figure 6). The model is easy to use due to the large amount of resources built around it. It also covers many of the elements of other business model frameworks. Therefore, the business model canvas framework serves as a basis for developing a business model in this thesis. Business model development will focus on sector specific questions presented in table 6 on the next page. The aim is to find optimum solutions for each sub-question.

Table 6. Research questions based on the business model canvas framework.

Key Partners	• Which functions to outsourced?
Key Activities	• What route length and route structure to utilise? • What airport base and region to operate in? • What type of operations to conduct and with what fleet size?
Value proposition	• What should be the main value propositions?
Customer Relationship	• How should you interact with customers?
Customer Segment	• Which customer segment to target?
Key Resources	• What are the key resources?
Distribution Channel	• What are the best sales and marketing channels?
Cost Structure	• What do planned operations cost and how to cut cost?
Revenue Stream	• What are the revenue streams and how can they be increased?

3.2 Business Model Context

This section contains a literature review and analysis of some industry specific areas needed to answer the research questions and develop a business model. The purpose is to place the business model framework in an industry context and present industry characteristic to serves as a basis for research in chapter 4. The sub-sections are titled and organized in an order based on connection with the business model canvas categories presented in table 6.

3.2.1 Key Partners: Operator Functions and Outsourcing Strategies

EASA rules that certain air operator functions must be carried out in-house, e.g. safety management, some company security functions and certain tasks of continuous airworthiness management (EASA, 2012). The air transport industry margins are small and it is thus necessary to examine strategies allowing to be more efficient. Outsourcing when correctly applied can be one source of efficiency. In contrast, an IATA study lists vertical integration as a way of reducing market risk and improve customer experience (Pearce, 2013).

Below is a list of some important functions linked to the air transport sector:

- Maintenance;
- Ground Handling;
- Sales and Marketing;
- Employee recruitment;
- Flight planning and dispatch;
- Operational planning/control (e.g. scheduling, crew control etc.);
- Training; and
- Quality control.

Literature provides principles for the strategic outsourcing decision to be applied. Theory on strategic outsourcing suggests that core competencies shall be held and rest should be outsourced (Quinn and Hilmer, 1994). Therefore, functions having a high strategic importance should be carried out in-house. A study by Hietala and Kuoppa (2009) lists aspects most often mentioned in literature that affects the outsourcing decision. Cost reduction and concentrating resources on core functions appear to be most frequently cited. So, the more capital or resources other than core functions require the more it makes sense to outsource. These aspects and the overall easiness to outsource air operator functions will be considered in survey questions used to analyse the outsourcing decision in section 4.1.

3.2.2 Key Activities: Business Aviation Airports

Airports can be divided into international hubs serving long-haul services, secondary airports focusing on intra-European travellers and regional airports served by smaller aircraft. In numerical terms, small airfields represent the largest group of airports even though 100 of the biggest airports in the world account for roughly 60% of passenger flows (Wittmer et al., 2011). Per statistics, airports with fewer than 100 daily departures handle 70% of Europe’s business aviation (Oxford Economics, 2012). Marsh (2006) points out that congested airports might not serve small charter aircraft during peak hours since schedules are not pre-determined and slots might play another factor. Light aircraft are also more sensitive to turbulent wake vortices and can’t land as early behind a large jet aircraft as a second large jet aircraft can. Wickart (2016) raises his concern in an interview that due to European airspace restrictions it is getting more limited to obtain landing slots and access to popular airports. Based on an FAA study conducted in the US, only a transfer of 2% of commercial airline passengers to small business aircraft would lead to a threefold increase in the number of take-offs and landings for air traffic control to handle (Tripsas et al. 2009). Roch (2016) notes in an interview that major airports in Europe have very expensive landing fees, up to 1300 euros per landing.

It is worth to remember that accessibility is a key requirement for the airport since time savings is the number one value added for passengers using business aircraft as suggested in sub-section 3.2.6. Wittmer et al. (2001) argues that situational demand is important when looking for the right airport. New communities, natural resources in remote areas, industrial areas, large firms or construction projects may attract wealthy business travellers to use air charter services (Ibid.). Tourism can also attract customers even though leisure travellers are generally more price sensitive. Additionally, security plays an important role since access control and screening impacts both actual security and how passengers perceive security. At the same time these may contribute to delays at airports so it is important the security control works smoothly. Queuing times are ranked as the most frustrating elements of security screening in an IATA Gallup, with 45% of passengers stating it to be the most frustrating (Tyler, 2015). Fortunately, security threats posed by terrorists are lower for aircraft with a few passenger seats. Finally, Wittmer et al. (2011) urges air operators to consider airport intangible factors such as ownership, state support, regulations, taxation, environment restrictions and air traffic control restrictions when deciding on the right airport as these aspects can often impact effectiveness, efficiency and profitability.

Recommendation: Look for easily accessible and less congested secondary or regional airports with a high situational demand.

3.2.3 Key Activities: Route Structure Options

Cento (2009; 29) claims the "network is a key strategic factor of airlines, as it is the main driver for generating revenue and cost as well as a source of competitive strength or weakness". Wittmer et al. (2011) describes the network structure, operator brand and customer basis as the only three strategic resources of an air operator, the core being network management. Any qualified airline in the European Union holding an AOC granted by EASA can conduct commercial air transport and freely allocate resources inside any other EU state. Airlines are free to set fares, adjust capacity and plan routes as they like. Business aviation has typically aimed at offering many destinations to a low volume of passengers (Thomas and Roger, 2012). An analysis on 800 000 business aviation flights in 2014 shows that 27% of the flights and 25,280 airport pairs where not connected with scheduled commercial flight alternatives (Booz Allen Hamilton Inc., 2016). An Oxford study states that 96% of city pairs served by business aviation has no direct scheduled commercial flight available.

A single trip on an aircraft is referred to as one leg and legs can be further divided into revenue legs where customers pay for the trip and empty legs creating no revenue. Route costs are driven by economy of scope, economy of density and route length (Cento, 2009). The usual aim with route structure planning is to maximise customer acceptance, minimise cost and maximise revenue. Jong (2007) claims that to optimise charter operations, an important way to minimise cost and maximise revenue is to avoid empty legs.

Statistics show that ten years ago half of the flights flown with business aircraft in Europe were less than 500 km long, only 9% were over 2000km and the most common flight range was between 300 km and 400 km (Marsh, 2006). Archer et al. (2012) study shows that charter flights should not exceed 350 Nautical miles (Nm)[2] in point-to-point distance. The same study state that the average route distance was lowest for the PC-12 aircraft at approximately 250 Nm and their overall conclusion was that the ideal air taxi route length is between 200 Nm and 500 Nm. Shorter distances seem to be more economical with personal vehicle transport. Statistics on the average flight duration for business aviation aircraft in Europe supports the optimum route length for the PC-12. Eurocontrol statistics reveal the average sector length for business flights in Europe to be 105 minutes (Booz Allen Hamilton, 2016).

There are two basic network strategies in air transport, namely a hub-and-spoke system or a point-to-point network. The hub-and-spoke system utilises connecting flights to feed passengers to their destination, while point-to-point networks offer passengers a direct flight from their origin to destination. Hub-and-spoke systems benefit of economies of scale, scope and density concentrated at large networks and arising from hub dominance. The downside with a hub-and-spoke system is that their use might not be attractive for passengers if transfer time gets long. This problem is most often tackled with a so-called wave system where incoming flight schedules are synchronised with outgoing flights. However, waves create peak times which might induce delays and possible missed connections. (Cento, 2009). Point-to-point networks rely on strong individual

[2] One Nautical mile = 1,852 kilometres (International Bureau of Weights and Measures, 2006).

markets providing enough passengers to fill up the aircraft without feeding traffic and are operated with less complexity (Wittmer et al., 2011).

The number of city-pair combinations in a hub-and-spoke system is n(n-1)/2 where n is the number of airports (Cento,2009). Point-to-point networks require the same number of routes as city-pairs (Ibid.). This increase in variety with a decreasing cost for the hub-and-spoke system lead to economics of scope (Wittmer et al., 2011). Economies of scale occur if large operations offer increased specialisation that reduces unit costs (Ibid.). Economics of density arises from a higher level of productivity and quality once activities concentrate (Ibid.). Economies of scale and density are introduced in point-to-point operations in the absence of transfer passengers if operations concentrate at one base. Economics of density remain marginal for small sized business aircraft in any network structure. Cost reductions of point-to-point networks comes from simple cost-effective fleet and an intensive use of aircraft and crew (Cento, 2009).

For airlines, the route system is usually such that legacy carriers use a hub-and-spoke route structure while low-cost carriers use a point-to-point structure. Business aviation normally uses the point-to-point strategy, and it has not been widely studied whether small aircraft operators could benefit from using regional hub systems. Cento (2009) argues that 37% of the cost difference between low-cost airlines and legacy carriers is due to network and airport choice. He also presents an interesting trend how low-cost carriers turn their bases into small hubs once they grow. This signals that one key driver of hub-and-spoke systems is the size of the operator. Hub-and-spoke systems are often found in large cities while point-to-point network operators use smaller airports, so market size may be a second driver. This is backed up by a mathematic analysis conducted by Cento (2009), concluding that when the carriers own market is small a point-to-point strategy is more feasible. Borghouwt (2012) argues that an increase in traffic density and the following cost reduction is the main driver for hub-and-spoke-networks. He further notes that economies of scale can also be achieved at a single route level by increasing aircraft capacity and a subsequent reduction in unit cost.

Business aircraft are mainly used as charter aircraft and in on-demand operations point-to-point flights serve as the only viable option. An Eurocontrol study claims that point-to-point service provides business aviation its value (Marsh, 2006). Overall, literature argue that the main driver for a hub-and-spoke system is to fill large aircraft, which is not essential for small business aircraft. Since saved travel time is the number one value proposition for business aviation (refer to sub-section 3.2.6) point-to-point travel remains the obvious choice. An IATA survey revealed direct non-stop flights are the number one reason for choosing a specific flight (Tyler, 2015). However, concentrating aircraft at one base provides business aircraft operators benefits of scale. Advantages from concentration is more flexible crew and aircraft scheduling, shared fixed airport costs and a more intensive use of capital.

Recommendation: A point-to-point network with strong presence at the home base is recommended due to saved travel time and economies of scale.

3.2.4 Key Activities: On-demand Problem

Literature reveals a few challenges with on-demand charter flights. The first challenge is late scheduling, since the optimum routing is often planned with less than a 24-hour planning horizon and the ending location may remain open if the next day is unknown (Zwan et al. 2011). Hicks et al. (2005) claims over 30% of chartered flights are changed within 48 hours of the requested departure time. The second challenge occurs when flying to several destinations, since optimization would be easier and more accurate for fixed routes and destination airports as many variables depend on these (Ibid.). Optimization may include parameters like, crew duty scheduling, crew rest periods, fuel prices, airport/navigation fees, turnaround times, maintenance requirements and more. Yao et al. (2008) presents statistics in a research journal indicating that a set of 35 aircraft encountered 49 unscheduled maintenance events during one month. However, disruptions are not only a dilemma for unscheduled charter operations since these affect scheduled operations as well.

Data analysis based on Eurocontrol statistics indicates that business charter flights generate more and bigger peaks compared to scheduled traffic and consume a disproportionate amount of handling and flow-management resources. For daily variances business hours peak later in the morning and end earlier in the evening when compared to other scheduled traffic. Seasonality is a big issue when attempting to increase business aircraft utilisation. June and September are the busiest months for chartered business flights, while July and August phase a drop-in demand. Demand is easier to predict in scheduled operations and denied service in charter operation may lead to losing the customer. (Marsh, 2006).

The last challenge with on-demand flights is how to sell seats to more than one customer to make the flight more affordable for the client. It is easier to sell more seats for pre-scheduled flights and get the aircraft utilisation rate high to reduce overhead and capital costs per flight hour. Charter operators need to focus on minimising empty legs, while scheduled operators focus on load maximisation (Jong, 2007). Estimates reveal that the share of empty legs of all business aviation flights is in or near the range of 35% (Yao et al. 2008) and 40% (Marsh, 2006). Scheduled flights with business aviation aircraft would be more prone to competition from established medium- and large sized commercial jet operators.

Scheduled operations reduce flexibility for the customer to set up his own timetable. Wittmer et al. (2011) presents one way to tackle this problem, and that is increase the frequency of scheduled flights as it increases flexibility. Studies show that especially business passengers are more attracted by an increased frequency of flights (Ibid.). "The core offer of business aviation is the level of flexibility and responsiveness users gain compared to scheduled airlines" (Oxford Economics, 2012; 8). Overall, literature analysis leads to the following recommendation that may be difficult to achieved.

Recommendation: Develop operations that offer the flexibility of on-demand flights and the cost benefits of scheduled flights.

Before making a business model decision on type of activity, it is essential to specify what the regulations say about scheduled versus non-scheduled operations. ICAO has defined a distinction between scheduled and non-scheduled flights and lists business aviation under on-demand, non-scheduled commercial air transport services along with air taxi activity (ICAO, 2009). In the US non-scheduled commercial operations and scheduled operations fall into different regulatory collections (FAA, 2016). US business aviation companies may utilise annual memberships and specific time windows instead of exact times to reduce the risk of being classified as a scheduled airline (Tripsas et al. 2009). EASA only distinct between the following types of operations:

- Commercial Air transport (CAT);
- Non-Commercial Operations (NCO);
- Non-Commercial operations with Complex motor-powered aircraft (NCC); and
- Special Operations (SPO).

From a regulatory perspective both scheduled and non-scheduled commercial operations fall under the first category and both require an Air Operator Certificate (AOC). EASA Defines commercial operations as "any operation of an aircraft, in return for remuneration or other valuable consideration, which is available to the public or, when not made available to the public, which is performed under a contract between an operator and a customer, where the latter has control over the operator" (EASA, 2008). One relief applies to commercial non-scheduled air taxi operators, because new EASA flight time limitations for flight crew does not apply for air taxi, emergency medical services and single pilot CAT operations (EASA, 2014b).

Historically a distinction was usually made between scheduled air traffic and non-scheduled air traffic concerning traffic rights between countries and airports. In Europe, the distinction between scheduled and non-scheduled traffic rights was withdrawn and replaced by the joint term "air service" in 1992. Council Regulation No. 2408/92 (EU, 1992) assures that scheduled and non-scheduled traffic are equally regulated and no traffic right restrictions apply. (Reichmuth, 2008).

3.2.5 Key Activities: Special Operations

EBAA data shows that nearly 20,000 ambulance flights are being operated in Europe every year, which accounts for 2,5% of the total business aviation market (Booz Allen Hamilton Inc., 2016). Business aircraft offer a significant advantage to air ambulance, medical evacuation and live organ transfers. Medical specialist teams in the fields of cardiology, paediatrics, neo-natal and intensive care are for example utilising business aviation operators in a large extent (Booz Allen Hamilton Inc., 2016). The PC-12 aircraft can be converted to a medical evacuation configuration and be equipped with the most advanced medical technology (Pilatus, 2016a).

Another form of specialised operations is to use business aviation aircraft as a feeder aircraft for airlines. Wittmer et al. (2011) argues that many airlines want to provide their clients with integrated travel services, such as intercontinental flights in first class combined with connecting flights to smaller cities only served by business aircraft. He further suggests that business travellers value a large network which could well be achieved by partnering with an airline. Several studies point out that partnerships in the air transport industry can benefit both parties via cost reduction and an increased demand (Pearce, 2013; Cento, 2009; Wittmer et al., 2011). It is also easier for small operators to enter large airports with the bargaining power of large airlines. Studies indicate that a significant part of business flights must travel to or from a major airport (Lee, 2007).

3.2.6 Value Proposition

Creating a value proposition is part of a strong business model. To create a robust value proposition to the proposed business model, it is first important to examine what the current value propositions for business aviation users are. Johnson et al. (2008) argues that a business model can only be successfully designed after we understand the job and the offering that gets the job done. Who the customer is and what the customer values must be considered in the offering so further research in customer benefits is worthwhile. Targeting the business aviation market segment can be a good strategy when looked at from the perspective of an Oxford Economics (2012) research concluding that business aviation users value their flights eight to fifteen times more than commercial scheduled flights.

Literature review shows there is a strong value proposition for companies and individuals using business aviation. Studies have shown positive benefits for companies that utilise business aviation for their managers and employees travel needs. Dyment and Bosco (2001) carried out a study on shareholder value perspectives and concluded that companies using business aviation services outperformed non-users in return on assets and asset efficiency during the analysis period. A second report ordered by the National Business Aviation Association (NBAA) in the US claims companies using aircraft for business aviation were less affected by recession than non-users (Dyment, 2013).

Since the air travel market liberalisation, the number of passengers worldwide has increased significantly which put capacity constraints on the ground and in the air which in turn causes delays. According to Budd and Graham (2009) these delays give the business aviation sector a unique value proposition by avoiding most of these delays and creating a high-end market in parallel with the other commercial alternatives. Private business flights reduce travel time and add to travel comfort and business aviation may even save on ticket costs for companies where management and employees travel in first or business class (refer to section 4.3). Marsh (2006: 22) claims in his study on business aviation that "business aviation is not about taking passengers from the front of cabin of a scheduled flight and flying them in their own aircraft, instead business aviation fills a gap in scheduled services since most business flights are between cities not served by scheduled flights".

According to an IATA study, passengers value simple, smooth and hassle free air transport (Tyler, 2015) and this can better be achieved with business aircraft when compared to larger commercial jets. Marsh (2006) research revealed that only five percent of the city pairs covered by business aviation had a scheduled alternative. This suggests that one driver for using business aviation is the lack of scheduled service between the origin and desired destination. Similarly, Tripsas et al. (2009) argues the value proposition for air taxi services over airlines are time savings, flexibility, comfort and productivity.

A recent study on the economic impacts of business aviation in Europe split the benefits of business aviation between three key stakeholder groups: employers, employees and customers/clients (Booz Allen Hamilton Inc., 2016). The benefits described in the study can be summarised as follows:

"Employer benefits:
- more productive employees during travel;
- less worktime spent on travel;
- increased market reach;
- enables easier interaction with clients; and
- reduces hotel, per diem and airfare costs.

Employee benefits:
- faster travel allowing an earlier return home;
- increased perception of security; and
- increased comfort and reduced stress while traveling.

Client and customer benefits:
- support staff more response time to client needs; and
- faster access to business partners."

The study claims the average time saved using a business aviation flight is 127 minutes over the second-best transportation alternative. An interesting observation is that much of this saved time emerges from the reduced time to and from business aviation airports when compared to large commercial airports. More interestingly, one fifth of business aviation flights save over 5 hours for the traveller and this might originate from the fact that 31% of the city pairs served do not have a non-stop scheduled commercial flight alternative available. If three or more legs are flown by the customer during the same day, then business aviation offers even more advantages. Statistics show that these multi-leg missions offered an average time saving of 6 hours and 33 minutes when compared to the best available scheduled commercial airline option, however, only 2% of European business aviation trips are multi-leg missions. Figure 7 (Booz Allen Hamilton Inc., 2016) illustrates how these timesaving's are spread across Europe. The time savings when using charter flights are greater in Eastern Europe and in the continents periphery where travel distances are longer. (Booz Allen Hamilton Inc., 2016).

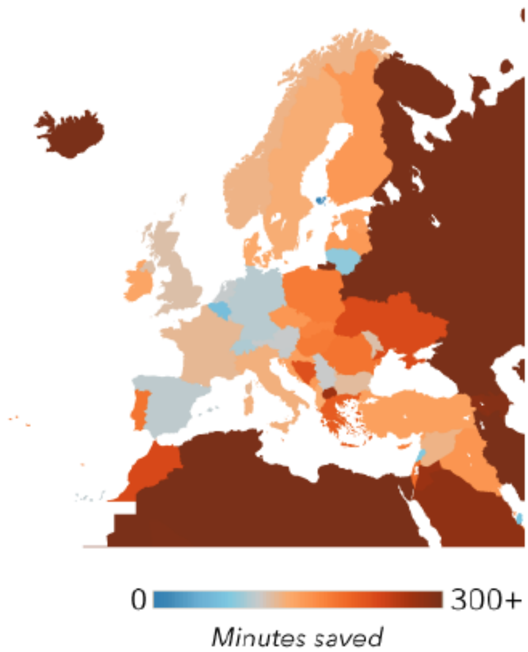

Figure 7. Average time savings in Europe when using business aviation. Source: Booz Allen Hamilton Inc. (2016) for EBAA, reprinted with permission.

A single trip in business aviation enables on average 155 minutes more productive work by one employee when compared to an equivalent commercial flight (Booz Allen Hamilton Inc., 2016). A study on the economic impact shows that the time savings and increased productivity in Europe together equalled 1.2 billion euros in saved salaries in the year 2014 (Ibid.). Employees can reach more customers during the same day and teams travelling privately can more easily discuss sensitive topics on-board without being overheard by other passengers. A survey conducted for the same research indicate that employees consider time spent on business aviation aircraft to be even more productive than time spent at the office. Companies are estimated to save approximately 75,000 overnight hotel stays in Europe each year when employees can travel home on the same day with business aviation aircraft (Ibid.). Some argue the importance of reaching customers for face-to-face business meetings is getting less important when conference call technology develops further. However, two-thirds of business aviation clients taking part of a survey conducted by Oxford Economics (2012) answered that face-to-face contact is important when making business. The increased perception of travel security may evolve when public areas are avoided at more exclusive airports and perceived risk for terrorism and contracting diseases reduce.

To analyse the productivity when travelling on business aviation aircraft, it is worthwhile to look at a survey that Krane and Orkis (2009) conducted for the NBAA in the US. A total of 289 passengers using business and commercial aviation aircraft answered the questionnaire and results show that passengers rate their productivity on business aviation aircraft 20% higher than office productivity. In the same survey productivity on commercial aircraft was rated 40% lower than in the office. Passengers were asked what percentage of time they used for specific activities and the results are shown in figure 8 (Krane and Orkis, 2009).

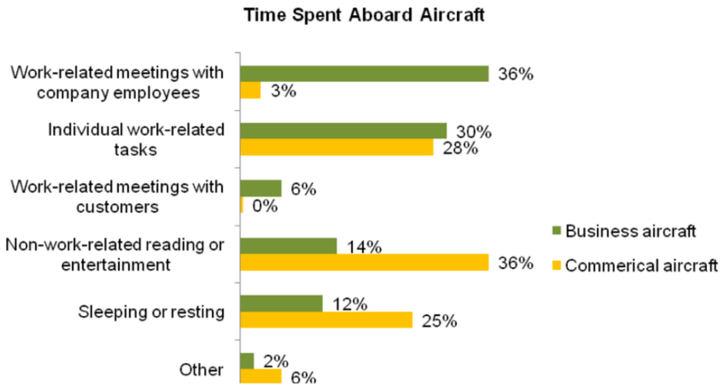

Figure 8. Percentage of time spent on different task on board business and commercial aircraft. Source: Krane and Orkis (2009).

Krane and Orkis (2009) Survey also revealed that 64% of passengers choose business aviation aircraft because scheduled airlines schedules cannot be met. In the US, 47% of business aviation flights are conducted to airports with infrequent or no scheduled airline services, 33% to secondary airports and only 19% to large commercial airports (Ibid.). This supports other literature underlining the importance of schedule and reachability of unserved locations.

Stepp and Behrmann (2001) study on business aircraft use came to a similar list of benefits derived from the use of business aviation aircraft for travel. The list is presented below:

- ”Employee time savings;
- Improved en-route productivity;
- Strategic transaction efficiencies;
- Protection of intellectual property;
- Improved customer retention or capture;
- Supply chain improvement;
- Product and production cycle improvement;
- Employee safety and security;
- Risk management;
- Direct travel expense savings;
- Increased personnel retention;
- Charitable missions (corporate image and brand recognition); and
- Charter revenues.”

According to an academic paper by Budd and Graham (2009), often cited value propositions of business aviation includes factors such as: increased time efficiency, improved safety, less airport hassle, reduction in time spent travelling, access to more airports, control of flight schedules and a positive corporate image. Increased employee productivity was found to be the most frequently cited benefit of business aviation per the study.

Recommendation: Accomplish and communicate some of the most important customer value propositions of business aviation.

Below is a composed list on the most important customer value propositions of business aviation based on literature analysis in this sub-section:

- ability to use airports that airlines don't serve;
- increased travel comfort;
- increased travel privacy;
- cost savings;
- saved travel time;
- less hassle and travel delays at congested airports;
- allows for higher productivity during travel;
- flexible schedules; and
- higher perceived safety and security.

3.2.7 Key Resources

Johnson et al. (2008) claims key resources to deliver value proposition to the target customer in any business include; employees, facilities, equipment, channels and brand image. Wittmer et al. (2011) identifies the key resources in driving air transport operations to be:

- brand image;
- service level;
- hub dominance; and
- customer relationship management.

Lee et al. (2007) points out that brand recognition in the business aviation industry is minimal since available services and businesses are limited. Service level is a sum of a wide range of attributes like, lounge access, inflight entertainment and meals. For business travellers, services like internet and traditional newspapers on board are important while leisure travellers are looking for on-board entertainment. Hub dominance offers the best connections, and it is perceived feasible to concentrate services to one or a few airports. Customer relationship management is discussed in sub-section 3.2.9.

3.2.8 Key Resources: Aviation Employment

Statistics show that one business aircraft generates 7.67 jobs for aircraft operators in Europe (Booz Allen Hamilton Inc., 2016). Oxford Economics (2012) asked business aviation operators where their personnel are located and a majority indicated that they live within a ten-mile radius from the local airport. The reason they provided was a fast response to customer demand. According to a report supported by the European Commission, the most significant cost-cutting technique used in the European aviation industry is an increased labour productivity (Jorens et al., 2015). Wittmer et al. (2011) claims low cost carriers gain a significant cost advantage from non-union labour.

Fixed term work agreements are common in the business aviation sector as they respond well to seasonal changes in demand. However, the costs of training and maintaining skilled labour might spill away once seasonal employees are harder to get committed to the firm. Oxford Economics (2012) study estimate the training costs for pilots to be around 20 to 30 thousand euros, for mechanics around 5000 euros and for administrative staff around 3500 euros per year. Most European countries provide regulatory limitations to fixed term contracts in terms of duration (Jorens et al., 2015). Using working agencies also provide flexibility to seasonal fluctuation and may reduce costs when some of the business risks shift to the self-employed worker (Ibid.). However, this type of subcontracting may introduce legal issues and from a whole European perspective, direct employment remains the most common form of employment due to various national laws (Ibid.). For small business aviation companies to stay cost effective it is common that pilots do parts of the administrative tasks to keep the overall headcount low (Auterinen, 2016).

One job advertisement page online claims regional first officers earn between 29 and 57 thousand euros and regional captains between 57 and 100 thousand euros per year (Flightdeckfriends.com, 2016). These estimates are close to what PC-12 pilots could earn a year by working full time. A survey conducted by Jorens et al. (2015) shows that the most common salary structure for pilots is a monthly lump sum plus extras (37%), the second most popular is a monthly lump sum (20%) and some are paid by the hour with (14%) or without a minimum monthly pay (7%).

3.2.9 Distribution Channel: Sales and Marketing Channels

The overall air transport market is characterised by online distribution while business aviation as a niche is still reliant on brokers. Online sales channels provide a cost benefit and there exists a large cost reduction opportunity in moving the focus to online sales instead of using brokers. Online sales can reduce distribution costs by over 75% and distribution channels can be used as a market entry barrier (Wittmer et al., 2011). Clive Jackson, the CEO of FlyVictor, claims in a recent article that online offerings form less than one percent of the market, but he estimates this to change fast (Fly Corporate, 2016b). Similarly, a study commissioned by EBAA estimated online sales to be higher, at around 2 percent in 2015, while indicating 60% of the market is controlled by brokers (EBAA, 2015).

Success in business aviation is driven by customer recommendations, frequent bookings, reduced price sensitivity and purchasing more services from the same company. Perceived customer value defines the basis of long-term customer relations and loyal customers contribute to success. (Wittmer et al., 2011). Wittmer et al. (2011) recognizes customer relation management and the right marketing channels as two of the most important marketing instruments for air transport operators. It is very expensive to acquire new customers and more cost effective to attract existing customers. Linear air’s CEO for example calculated that they had to spend 310 USD for every new customer in an air taxi company (Tripsas et al. 2009). Personal recognition for business travellers is appreciated and adds to customer loyalty so a customer database is crucial. Customer loyalty programs might be one efficient and cost effective way of keeping customers loyal. According to studies customer's value frequent flyer points more than their actual monetary value (Wittmer et al., 2011). Research shows that customer loyalty programmes lead to more frequent purchases, word of mouth and reduced price sensitivity (Ibid.).

3.2.10 Cost Structure: Cost and Profitability Analysis

The air transport industry is capital intensive and therefore characterised by high fixed costs, the greatest cost being financing of new aircraft. Relatively low variable costs and direct operating costs make it possible for air transport companies to lower the seat pricing in competitive situations even though this is not feasible in the long run unless fixed costs are covered (Wittmer et al., 2011). It is widely known the airline industry does not pay equity investors much profit for risking their capital. During the past 30 to 40 years the airline industry has generated one of the lowest returns on capital among all industries (Pearce, 2013). During the period between 2004 and 2011 returns on invested capital has been 4.1% on an average in the worldwide airline industry (Ibid.). The yearly performance is shown in figure 9 (Pearce, 2013).

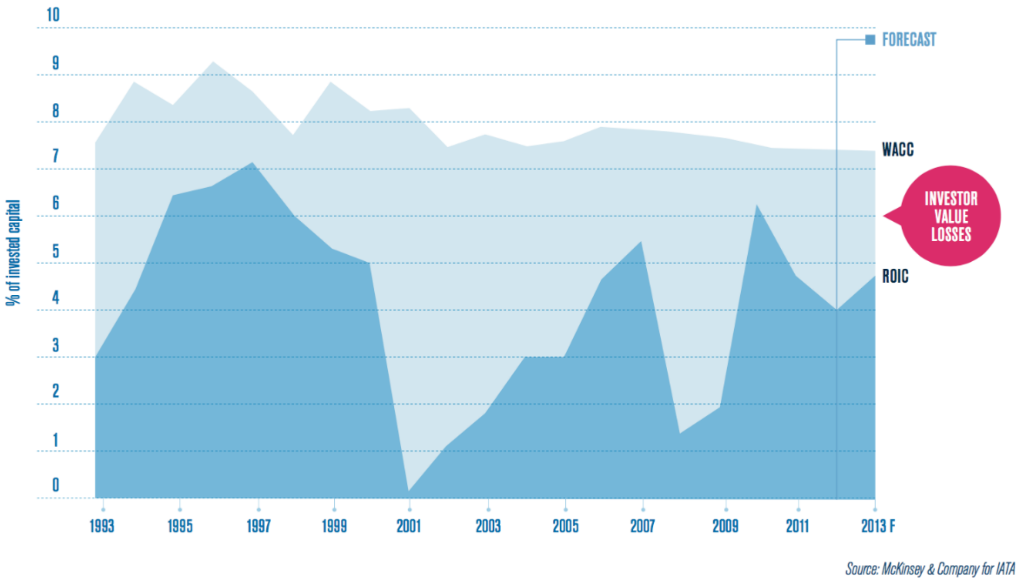

Figure 9. Return on invested capital in airlines and their WACC. Source: Pearce (2013).

IATA notes that the average WACC for the whole industry is 7,5% meaning this is what investors would earn by investing their capital in assets of similar risk outside the airline industry (Pearce, 2013). Another research estimates the average WACC to be 6% for the airline industry (Wojahn, 2012). The business aviation sector is assumed to be at least as risky as the entire airline industry.

The cost of providing air transport consist of fixed overhead costs, direct operating costs and other variable costs. In simplified cost modelling, the cost of the trip depends on flight hours, airports used and navigational fees (Jong, 2007). The direct operating costs include fuel, airframe maintenance, labour and parts, engine restoration and other miscellaneous variable costs directly linked to the flight (Conklin & de Decker, 2016).

Marios Belidis (2016), the CEO of a company operating PC-12 aircraft in the Middle East state he includes the following variables in the direct operating cost calculations:

- maintenance, including labour and parts for the airframe, engine and avionics;
- engine and propeller restoration;
- crew expenses like per diem, hotel and transportation;
- fuel consumption;
- other consumables like oil etc.; and
- interior refurbishment.

Other variable costs include handling fees, landing fees, parking fees and air navigation fees. Crew costs are considered fixed or variable based on flight hours depending on the form of crew employment contracts (Jong, 2007). Fixed costs include administrative fees, training, hangar rent, insurance fees, aircraft refurbishing and miscellaneous subscriptions for navigation, weather and maintenance systems (Conklin & de Decker, 2016). Aircraft capital costs are further analysed in the next sub-section. Estimate shares of the various operational costs and flight expenses in business aviation are presented in figure 10 (EBAA, 2012). It is worth to note that fuel costs had fallen from 21% of the total operating costs to only 10,5% between the years 2012 and 2015 (EBAA, 2015). Additionally, fuel costs make up a lower proportion of the total costs for a single engine turboprop aircraft due to their fuel efficiency.

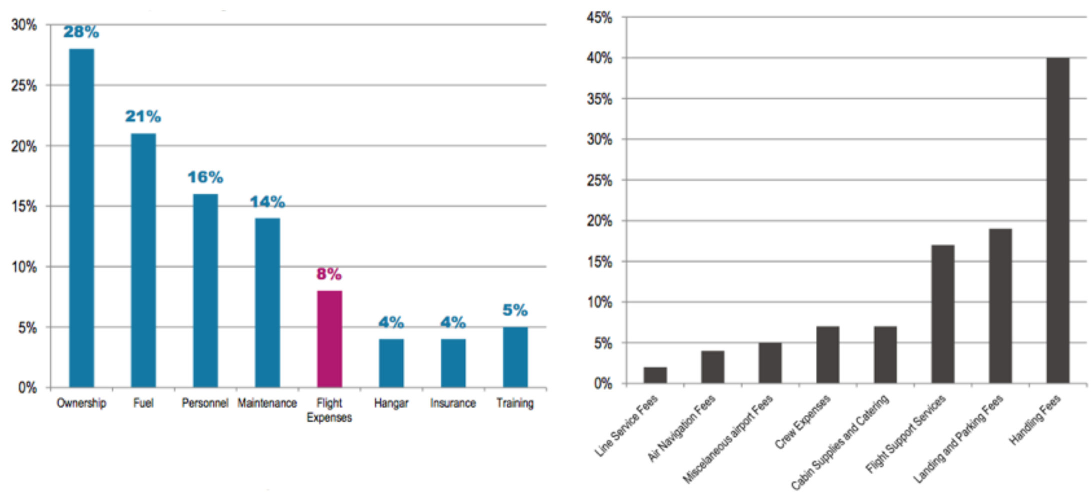

Figure 10. Direct operating costs and share of flight expenses for business aviation in 2012. Source: EBAA (2012), reprinted with permission.

Wittmer et al. (2011) recognises three overall strategies an air operator can pursue to be profitable, namely, the quality leadership strategy, the cost leadership strategy or niche carrier strategy. Operators achieving the quality leadership strategy can achieve a higher willingness to pay and the need to compete on price reduces. However, previous studies show that an increasing portion of airline business passengers are choosing price over service on short routes (Wittmer et al., 2011). The cost leadership strategy aims at a high labour and capital productivity. Cento (2009) lists attributes making up the cost leadership strategy for airlines to be a high aircraft utilisation rate, internet booking, use of secondary airports, one class of seating, short turnaround time, point-to-point service and ancillary services. The niche strategy aims at serving a limited customer segment and the product can be service related, geographically defined or offer a cost advantage.

3.2.11 Cost Structure: Aircraft Finance Options

There are two main options for aircraft usage and these are acquisition and lease. Acquisition costs include to cost of capital and deprecation. If the acquisition is debt financed, then debt administration plus an interest cost is added to the list. Leasing costs include the capital cost of asset depreciation, the interest rate charges, administrative costs and the cost of transferred residual risk. Leasing is considered the less risky but more expensive decision. The main benefit with leasing is that it provides financing and capital investment reduces.

Ali et al. (2013: 31) listed in their study conducted at PwC reasons for the attractiveness of leasing in the airline industry:

- "Flexible fleet portfolio and risk mitigation;
- Access to attractive delivery slots;
- Availability of capital as lessors with a better risk profile can access more and relatively cheaper capital;
- Avoid pre-delivery payments;
- Residual value risk rests with the lessor; and
- Utilisation of freed-up liquidity to finance growth or day to day operations."

Allonen (2013) argues in his master's thesis that tax treatment is one major reason for lease agreements since lease payments are fully tax deductible and that flexibility is another commonly used justification. The benefits of purchasing an aircraft are that the operator has more influence on the aircraft configuration and additionally purchasing seems to be the preferable choice for a longer time-period (Allonen, 2013). There are two forms of aircraft lease, namely operating lease and financial lease. Operating lease means that the aircraft is owned by the leasing company after the agreement period while financing lease means that the operator will own the aircraft at the end of the agreement. Financial lease is therefore assimilated with holding a debt. Half of the worlds aircraft operate under a lease agreement and around 80% of lease agreements in the aviation industry are operating leases (Ibid.).

In a survey, different air operator chief financial officers were asked to rank their financing options and the result was as following (Gibson, 2005):

1. Internal funds
2. Minimise cash out by leasing
3. Debt finance
4. Equity finance

Fixed depreciation and interest costs are normally used to simplify investment calculations. To make capital budgeting and investment calculations more simple, literature often assumes that aircraft depreciate to a residual value of 0% over a certain depreciation period (Jong, 2007). Gibson (2005) concludes that airlines tend to use cost of debt discount rates and the lack of using cost of equity points out to the possibility that air operators may underestimate their true cost of finance.

3.2.12 Revenue Streams: Pricing Models

Pricing represents one of the core functions of an airline and the pricing strategy often aims at targeting each passenger's maximum readiness to pay. The air transport providers mainly use pricing to stimulate demand to maximise profit or minimise empty legs. The most common technique for pricing in the airline industry is the so called "yield management pricing" aiming at achieving every individual's maximum readiness to pay (Wittmer et al., 2011). Cento (2009; 33) defines yield management as "a systematic approach to applying pricing and inventory controls to the sales of perishable assets". Yield management pricing leads to price discrimination meaning that higher fares are charged for clients with a higher willingness-to-pay. One key driver affecting air transport pricing is that unsold seats can't be reused after the flight has commenced and costs to operate the available seats are considered sunk costs. The most common way to apply yield management is by charging high yield business travellers more for a premium service or adjusting price dynamically based on demand as shown in figure 11 (Cento, 2009). In case the sold tickets do not follow the optimal path the price is adjusted up or down in order for tickets to follow the optimal path. The difficulty in price discrimination is not to cannibalise high end sales when offering cheap ticket options. In order not to target discounts for passengers willing to pay more so called "fencing" strategies may be used (Wittmer et al., 2011). Booking classes play the most important fence in major airlines. However, it is hard to sell different booking classes or to plot an optimum price path for small business aircraft in case tickets are sold on a per seat basis. All bookings in business aviation can be perceived as a valuable first class offerings, which is important since the unit price is considerably higher than for a regular airline ticket.

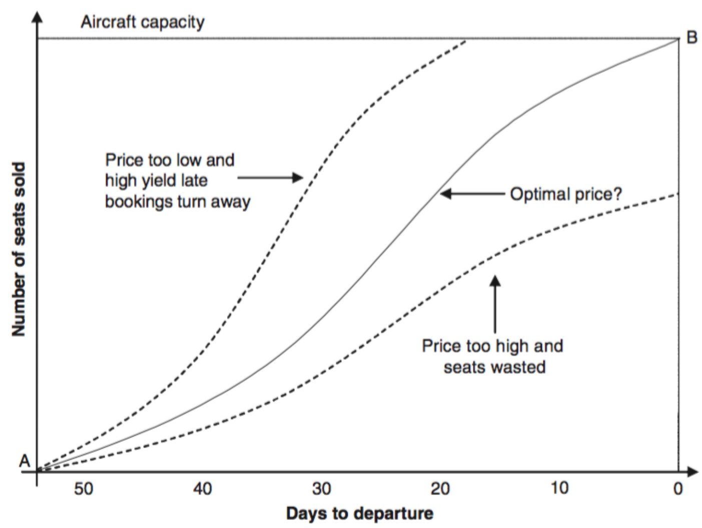

Figure 11. Dynamic airfare pricing. Source: Cento (2009).

Flat rate pricing has been discussed for air transport since it requires less investment in yield management. However, Wittmer et al. (2011) claims in his research that when flat rates have been competing with flexible pricing, it has failed. Customers are not willing to pay slightly higher prices that are needed to cover the costs even when long-term stability and transparency is gained. Research also shows that if customers know why they pay more and when price discrimination is not only about increasing airline profits, they will accept it (Wittmer et al., 2011).

Monthly membership pricing is common for fractional ownership models, however, there are interesting examples of monthly pricing amongst commercial operators as well. For example SurfAir, a PC-12 operator in the US planning to expand to Europe, has introduced an “all you can fly" membership model where customers pay a monthly fixed price for flying (Surfair.com, 2016). Since the air charter industry is full of trips with empty legs and seats, the "all you can fly" concept gets interesting. Another interesting new pricing model is for passengers to charter a flight and sell seats they don’t need. Another US operator called Blade has worked this out by giving passengers credits for sold seats that can be used towards future flights (Blade.com, 2016).

Recommendation: Introduce a pricing model that will attract new customer segments to business aviation. In scheduled operations, the pricing model needs to compete with airline competitors and substitutes.

4 Business Model Development

This chapter defines the final business model based on an analysis of interview and survey data gathered for this thesis. The separate sections are divided based on the nine elements of the "business model canvas" framework introduced in section 3.1 and all sections in this chapter aim to answer a separate research question. Prerequisites and recommendations of chapters 2 and 3 are taken into consideration in the analysis. Since the interviews were conducted in a semi-structured fashion, the interview information has been categorised based on the different sections. The interviews are mainly analysed using a deductive approach where interview observations are reflected to theory presented in chapters 2 and 3. Some sections utilise an inductive method where interview findings simply lead to a conclusion or theory. Survey data is mainly used to support interview findings.

To strengthen the interview analysis, the interviewees different expertise are presented in the table 7. Categorising interviewees in expert groups based on their expertise makes it easier to justify why an interviewees opinion is relevant or trustworthy regarding a specific subject.

Table 7. Introduction of interviewee expertise and expert groups.

Name of Interviewee (interview reference)	Industry Expertise	Operational Expertise	Piloting Experience	Business Expertise	Sales and Marketing Expertise
Aalto, J. (2016)	X	X	X		
Auterinen, M. (2016)	X	X	X	X	X
Belidis, M. (2016	X			X	X
Cordova, G. (2016)	X	X	X		
Evans, P. (2016)	X	X		X	X
Korkelainen, A (2016)	X	X	X		
Krohn, C. (2016)	X			X	X
Lawlor, D. (2016)	X			X	X
Lees, M. (2016)	X	X		X	
Roch, Y. (2016)	X	X		X	X
Viro, J. (2016)	X	X	X		
Wickart, L. (2016)	X	X		X	X

All the interviewees were selected because they have good insight in the business aviation industry and therefore belong to an expert group with "Industry Expertise". This group is also referred to as "industry experts" in the thesis. Interviewees are listed in the group "Operational Expertise" if they have been exposed to flight operational tasks in their work or have otherwise gained creditable insight in flight operations. The prerequisite used in table 7 for "Piloting Experience" requires that the person holds or has held a PC-12 class rating for pilots. Persons with "Business Expertise" have experience and insight in setting-up or managing businesses within the industry. Similarly, interviewees with "Sales and Marketing Expertise" have been exposed to sales and marketing related tasks in their work.

4.1 Key Partners

This section aims at answering which functions are viable to outsource in commercial PC-12 operations. The research method applied is a deductive approach where survey questions base on theory. For simplicity, only the eight air operator functions introduced in sub-section 3.2.1 are examined in this research.

The literature review in sub-section 3.2.1 suggest that it is most beneficial and viable to outsource functions that:

- reduces costs when outsourced;
- have a low strategic importance; and/or
- requires most resources and capital.

These form the basic hypotheses for analysing survey results and additionally the easiness of outsourcing is examined with one survey question. Ten experts answered survey questions asking to choose three functions in PC-12 operations that they:

- find most beneficial to outsource from a cost reduction perspective;
- consider has the highest strategic importance;
- consider requires most resources and capital; and
- considers easiest to outsource.

Functions to choose from were those introduced in sub-section 3.2.1 and additionally every individual question had the possibility to write any "other" function in a free text field. Full survey results are found in Appendix A (questions 6 to 10). Table 8 contains a score for each question and function combination based on the number of expert selections. Significant findings are starred in table 8 using a generally acceptable cut-off probability value lower than 0.05 (5%) for significance. This value indicates the probability that the score is obtained by coincidence. In the mean, standard deviation and probability calculations the “other” alternative is omitted.

Table 8. Outsourcing decision survey results scored based on number of selections.

Air Operator Function	Most cost reduction potential	Highest strategic importance	Most resource and capital intensive	Easiest to outsource
Maintenance	8*	3	7*	9*
Ground Handling	6	0*	4	9*
Flight Planning / Dispatch	7*	1*	0*	4
Training	3	5	8*	3
Sales and Marketing	4	6	3	2
Employee Recruitment	0*	8*	5	3
Quality Control	0*	1*	1*	0*
Operational Planning / Control	1	6	1*	0*
Mean / Standard Deviation	3.625 / 3.159	3.750 / 2.915	3.625 / 2.925	3.75 / 3.536
“Other”	1[1]	0	1[2]	0

* Significant finding with probability value less than 0.05. Probability value calculated with t-test.
[1] Answer: “Maintenance if fleet under 6 aircraft”. [2] Answer: “Aircraft cost of capital”.

Survey analysis signal that the outsourcing of maintenance offers most cost reduction potential, has a relatively low strategic importance, is resources-/capital-intensive and is easy to outsource. If assumed that theory proposed by literature in sub-section 3.2.1 holds then survey results signal that maintenance should be outsourced. Similarly, results indicate that ground handling offers cost reduction potential, has a low strategic importance and is easy to outsource, meaning that ground handling is also feasible to outsource.

According to survey results, outsourcing of quality control offers no cost reduction potential, it is difficult to outsource and uses relatively less resources and capital. These findings signal it is not viable to outsource quality control. Operational planning and control showed similar results and seems to be strategically important, indicating the function should be kept in-house. Additionally, employee recruitment shows no cost reduction potential and has a high strategic importance signalling it should also be kept in-house.

Conclusion: Maintenance and ground handling should be outsourced, while quality control, operational planning/control and employee recruitment should be done in-house in the recommended PC-12 business model.

The survey results are too uncertain to draw conclusions whether flight planning/dispatch, training and sales/marketing are feasible to be outsourced. The survey did not either reveal whether the theory concerning the outsourcing decision hold or not. Other weaknesses and uncertainties of the survey and research findings exist. First, the list of air operator functions is not complete and there remain functions that where not analysed in this thesis. Secondly, the four theory driven questions used in the analysis where not weighted based on their relative importance. Finally, the literature driven reasoning contains shortcomings in building up theory.

4.2 Key Activities

This section focuses on answering the following three research questions connected to the aircraft specific business model;

- What route length and structure to utilise?
- What airport base and region to operate in?
- What type of operations to conduct and with what fleet size?

The research methods used is this section are both inductive and deductive interview analysis and survey results are used to support the findings. To answers the research questions in this section, it is important to identify the aircraft strengths and weaknesses. Therefore, this section starts with an interview based SWOT analysis where potential opportunities and threats are identified as well.

4.2.1 SWOT Analysis

The research method to evaluate strengths, weaknesses, opportunities and threats in this sub-section is an inductive approach, where interview observations are analysed to find patterns and repetitive claims to form theory. The strength findings are supported with qualitative survey result analysis. Business model opportunities are additionally analysed with a theory driven approach (deductive). Categorisation by expert groups introduced in table 7 are used to support individual interview arguments and findings.

Strengths

Industry experts were asked in thesis interviews what they consider are the strengths and weaknesses of the Pilatus PC-12 aircraft. The top seven features correspondents find as strengths of the aircraft were:

- **High residual value** (Wickart, 2016; Lawlor, 2016; Evans, 2016; Belidis, 2016; Auterinen, 2016, Roch, 2016);
- **Passenger comfort** (Cordova, 2016; Lees, 2016; Auterinen, 2016; Lawlor, 2016);
- **Aircraft performance** (Evans, 2016; Korkelainen, 2016; Auterinen, 2016; Viro, 2016);
- **Low operating costs** (Evans, 2016; Wickart, 2016; Lawlor, 2016);
- **Versatility** (Korkelainen, 2016; Viro, 2016; Auterinen, 2016);
- **Reliability** (Evans, 2016; Cordova, 2016; Auterinen, 2016); and
- **Flying characteristics** (Cordova, 2016; Viro, 2016; Korkelainen, 2016; Aalto, 2016).

Six interviewees with business expertise independently claim that a high residual value of the PC-12 aircraft helps making it a good financial investment. Roch (2016) states that the low depreciation of the aircraft is in his opinion the biggest advantage. This claim is further analysed in section 4.8.

Good passenger comfort in the PC-12 is due to a large and silent cabin. The PC-12 has a cabin comparable in size with more expensive jet aircraft, larger than the popular Cessna Citation Jet 2 (Lees, 2016) and the customer experience is almost the same as in a more expensive Phenom 300 (Wickart, 2016). Lees (2016) claimed in an interview that the PC-12 gives customers great value for money due to the superior travel comfort. Auterinen (2016) noted in an interview that part of the passenger comfort arises from the silent cabin made possible by the engine and propeller located at the front of the aircraft. The passenger comfort claims are perceived reliable since all claims came independently from interviewees familiar with the aircraft cabin.

When interviewees brought up aircraft performance as a strength of the PC-12 aircraft they were pointing at its good short field capability. Interviewees explained that a 1000-metre long runway is often sufficient for take-off and landing with this aircraft depending on temperature and load (Viro, 2016; Korkelainen, 2016). A Pilatus PC-12 marketing leaflet states the take-off distance to be as low as 793 metre, however, this is achieved in optimum conditions with a low take-off weight (Pilatus, 2016a). Short field capability opens new opportunities to operate to and from small fields other aircraft cannot serve. The reliability of this finding is probable as three claims came from persons with piloting experience on the PC-12 aircraft.

Low operating costs make it possible for operators to explore new business models with the PC-12 and focus on customer segments not used to fly on private aircraft. Interviewees note that the low operating costs are driven by to the low direct operating costs resulting from simple maintenance and a good fuel efficiency. David Lawlor (2016), the head of projects and corporate finance of Global Ideas, states in an interview that the cost per nautical mile per passenger surpasses all similar size of aircraft, especially with 6 to 8 passengers. On the downside, Auterinen (2016) notes that the acquisition cost of a PC-12 aircraft is high making it feasible to aim at a business model with high utilisation rates. Table 4 in section 2.5 made a comparison on the operating costs of the PC-12 to its nearest rivals and operating costs are further analysed in section 4.8. Interviewees arguing the low operating cost is a strength of this aircraft belong to the expert group with business expertise.

The aircraft is considered versatile because it is suitable for many kinds of operations. It has a large cargo door that makes it good for both cargo and medical evacuation operations (Auterinen, 2016). Additionally, the cabin can be configured for both business and commuter passengers with a different number of seats available (Korkelainen, 2016). On the downside PC-12 class rated pilot Aake Korkelainen (2016) notes that the loading of the aircraft can get troublesome with eight passengers and their baggage since it may cause centre of gravity to be too far aft. He recommends the aircraft is essentially seen as a seven seater in commuter operations. The versatility claims originated from interviewees belonging to the expert group of PC-12 class rated pilots.

According to Roch (2016) the Swiss quality is another advantage of the aircraft and Auterinen (2016) says the aircraft is overall well built, especially its fuselage and landing gear. Gabriel Cordova (2016), the head of safety and quality of a PC-12 operator in the Middle East, notes that the aircraft is not designed for intense use and high utilisation rates, however, with a correctly adapted maintenance programme he thinks the aircraft is reliable and will handle intense use. Viro (2016), the head of flight operations and crew training of a PC-12 operator in the Middle East, adds that the engine reliability on the PC-12 aircraft enables commercial operations. Reliability claims are supported by interviewees with either operational or piloting expertise with the PC-12 and are therefore perceived reliable.

Cordova (2016) stated that “most pilots love to fly the PC-12 aircraft”. Overall, persons with piloting experience on the PC-12 aircraft claims the flying characteristics of this aircraft are good. Korkelainen (2016) states the avionics are well designed to help in an engine out emergency so that the pilot can better focus on the emergency at hand. Another strength of the aircraft mentioned in interviews is its reliable de-icing characteristics (Auterinen, 2016; Korkelainen, 2016).

To support interview outcomes industry experts were asked to choose the top 3 strengths they consider the Pilatus PC-12 aircraft offers against its rivals out of ten alternatives being: *low operating costs*; *low acquisition cost; high residual value; travel comfort; short field capability; payload and range; cargo door; manufacturing* *quality; easy serviceability and maintenance; and other (specify)*. Survey results are found in Appendix A (question 3). Results show *low operating costs* (66,7%), *passenger travel comfort* (55,6%), *short field capability* (44,4%) and a *high residual value* (33,3%) are strengths of the aircraft that experts rank highest. This supports the interview findings and signals an order of importance. The survey additionally suggests that the aircraft *payload and range* (33,3%) and *cargo door* (22,2%) are strengths experts seem to value. However, further interviews and analysis are required to verify these. The two answers specified in the field other were transformability and cost per Nm per seat.

Weaknesses

Once the same industry experts where asked about the PC-12 aircraft weaknesses the following where most often mentioned:

- **Market perception of a single engine aircraft** (Wickart, 2016; Lawlor, 2016; Belidis, 2016; Evans, 2016; Cordova, 2016);
- **Aircraft not designed for intensive use** (Auterinen, 2016; Cordova, 2016; Korkelainen, 2016); and
- **Relatively slow when compared to jet aircraft** (Auterinen, 2016; Lees 2016).

Wickart (2016) notes that the main problem with the PC-12 aircraft is that you must convince clients it is safe to travel on a single-engine aircraft. Auterinen (2016) argues that clients do not seem to be sceptic about the safety of the PC-12 as a single engine aircraft, he states that somehow "the Swiss build quality raises confidence in passengers". Peter Evans (2016), the Chief Operating Officer of SurfAir Europe, adds that the perception of a single engine aircraft is a problem within the industry and states that "even many in the pilot community have negative perceptions of a single engine aircraft". In any PC-12 business model one challenge is to communicate the safety of the aircraft to clients. Recent safety statistics from the US and Canada show that the PC-12 is one of the safest business aviation aircraft, with an accident rate of 0.6 per 100 000 flight hours while the whole US fleet of business jets rate at 0.87 (Robert E. Breiling Associates Inc., 2016). Krohn (2016), who has experience in the business aviation broker market, notes that customers rarely ask safety questions about single-engine aircraft and they might not even notice the difference.

Auterinen (2016) states that the aircraft is not planned for high utilisation rates and that its weaknesses are the flap system and avionics from a maintenance perspective. Cordova (2016) shares the opinion with Auterinen, but notes that if the maintenance programme is reviewed and a reliability programme established then high utilisation rates can be achieved. These claims came from persons with piloting experience and further interviews with PC-12 maintenance personnel would be useful to support the finding.

The aircraft is relatively slow, making it optimal for short routes (Auterinen, 2016). Since it loses in speed with small jets it may even lose in price competitiveness on longer routes (Lees, 2016) and this limits the competitive range further evaluated in sub-section 4.2.2. Another downside related to operational characteristics mentioned in interviews is that the aircraft can't fly above all weather (Wickart, 2016). The PC-12 is certified to fly at a maximum altitude of 30,000 ft (Pilatus, 2016a), which leaves it well below the most congested levels between 35,000 ft and 39,000 ft (Marsh, 2016). The benefit is that lower flight levels may lead to ATC delays being less common and Eurocontrol states in a report that the business aviation strategy to avoid congested flight levels has proven to be successful (Marsh, 2016). When combined with the use of less congested small airports the delays are further reduced.

Opportunities

Lees (2016) notes that recent statistics show the market for small jets has grown, the same market that the PC-12 competes in. He also thinks Europe is moving closer to the US model where these kinds of aircraft are popular.

The biggest opportunity for commercial operations with the PC-12 aircraft in Europe is extracted from literature analysis in section 2.3, since EASA approved commercial SET-IMC operations across all member states in March 2017. The European open market provides a good platform for new air transport business models to grow and there remains a lot of growth potential in operations with SET aircraft. Industry experts expect SET-IMC operations to be popular in Europe because of the attractive operating costs (Fly Corporate, 2016a). The PC-12 is a common air taxi plane in the US where SET-IMC flights have been allowed commercially for a long time (Ibid.). Non-commercial flights with single-engine aircraft have grown with an average annual rate of 16 percent, suggesting that once commercial applications become readily available, the demand will be high (Koe, 2016). According to Wittmer et al. (2011) air transport demand is heavily driven by the supply side. By introducing commercial single-engine turbo propeller aircraft to Europe, customers can choose chartered air taxi operations with a discounted price. This might cause a similar effect that low cost carriers have caused to the airline industry. Interview findings from both business and operational experts supports the hypothesis that the new EASA SET-IMC regulations and demand for this category of aircraft belong to the biggest opportunities for this aircraft (Auterinen, 2016; Lees, 2016; Cordova, 2016).

Threats

Although the regulatory scene is an opportunity for commercial PC-12 operations in Europe, experts recognise a lot of potential threats behind it. The other threats repeatedly mentioned in interviews were a challenging competitive scene and threats related to a single-engine.

Seven industry experts explained in interviews what they perceive as the highest regulatory risk factors for SET operations in Europe before the new regulations were implemented. Perceived risks that recurred in many interviews were EASA's minimum weather requirements since if raised these could jeopardise SET aircraft's commercial viability. The second concern raised by industry experts was that EASA may allow SET-IMC operations with a single pilot and this is a potential safety risk. From an economic perspective, it would be desirable for an operator to fly commercial with one pilot. However, industry expert say that two pilots is the highest safety barrier recommended when operating in challenging environments (Auterinen, 2016; Lees, 2016). Lees (2016) is also concerned about pilot training costs that would realise if EASA sets a requirement for simulator training. There is no Pilatus PC-12 simulator available for training purpose in Europe and it would be such a huge investment that no operator could afford to pay the high hourly rates that a simulator investment would impose.

Overall, industry experts perceive the highest regulatory risks with commercial PC-12 operations in Europe to be linked to the regulatory collection. Even though a lot of data exist on commercial SET operations worldwide, it is a new territory for EASA and most of the European national regulators. Juuso Aalto (2016), PC-12 pilot and deputy head of flight operations of Hendell Aviation, noted that EASA regulators do not have the knowhow and competence for SET operations yet, which is the reason the regulatory framework is incomplete.

Five industry experts where asked in interviews how they see the competitive scene to be in the European business aviation sector and everyone found it to be challenging (Krohn, 2016; Auterinen, 2016; Lees, 2016; Evans, 2016; Roch, 2016). Yves Roch (2016), the CEO of a PC-12 management company in Switzerland, claims the market has been so competitive that players are forced to buy each other out to become bigger on the market. Evidence of this is shown by the recent consolidation in the European market mainly led by the Luxaviation Group as described in table 3 section 2.4. Evans (2016) states that "the biggest challenge business aviation faces regarding growth is the ownership model". He argues that the European business aviation sector is reliant upon managed aircraft that does not incentivize the management companies and assets are not sweated due to their owner's emotional connection to the aircraft. Auterinen (2016) further explains that many aircraft management companies do not consider the capital costs in their pricing. Both Evans (2016) and Auterinen (2016) claims another challenge is the sales chain taking a large piece of the industry profits. Yves Roch (2016), who operates PC-12 aircraft in Switzerland, states that prices for charter aircraft are constantly falling.

The main threat related to single engine operations is the possibility of an engine failure. PC-12 class rated pilots Korkelainen (2016) and Cordova (2016) state that the risk for an engine failure on the PC-12 is smaller than on twin engine aircraft, but the consequences may be more severe. Lees (2016) does not recognise an engine failure as a threat due to the low probability and considers that human errors are bigger threats to operations.

Other threats with a PC-12 business model derived from expert interviews are pilot availability (refer to section 4.6), security threats induced by the lack of a door between the cabin and the cockpit (Korkelainen, 2016), safety threats induced by poor financial capabilities of small operators (Cordova, 2016) and by low fuel quality at small remote airports (Aalto, 2016).

The results of the interview driven SWOT analysis are presented in figure 15.

Strengths	Weaknesses	Opportunities	Threats
• Low Operating costs • Passenger Comfort • Aircraft Performance • High Residual value • Versatility • Reliability • Flying Charecteristics	• Market perception of a single engine aircraft • Aircraft not designed for intensive use • Relatively slow when compared to jet aircraft	• Growing demand for aircraft segment • Upcoming EASA SET-IMC regulations	• Risks related to regulatory requirements • Challenging competitive scene • Failure of a single-engine • Pilot Availability

Figure 15. Results of the SWOT research.

4.2.2 Route Structure

This sub-section aims at answering what route length and structure to utilise in European PC-12 operations. Route structure development will start by finding the optimum route length based on quantitative reasoning combined with interview and survey data to back up literature findings. Once the optimum route length is found, the research continues to draw a conclusion on which kind of route structure to utilise.

Figure 3 in section 2.5 shows that the marginal number of ultra-long jets has grown, which signals that the average route length has grown. As per the literature review in sub-section 3.2.3 flights under 500 km are still most common. Longer routes are more profitable as it requires a lower number of booked segments to generate more revenue and get the aircraft utilisation rate higher to break-even. However, the PC-12 is slower than competing jet aircraft and to accomplish the customer value proposition of saved time this aircraft is expected to be competitive on shorter routes. Table 8 serves as an analysis by comparing the PC-12 aircraft flight time and cost with an entry level jet (Citation Mustang), a light jet (Phenom 300) and a medium-sized jet (Citation Excel) on 300 Nautical mile[3] (Nm), 600 Nm and 1000 Nm long missions.

Table 8 shows that the value proposition of saved time is partly lost on longer routes with the PC-12 due to its low speed relative to jet aircraft. On a 1000 Nm route a marginally more expensive Phenom 300 with 7 seats will save one hour and twenty-three minutes when compared to the PC-12. It is important to note that scheduled airlines are in the same speed range as a medium-sized jet. Table 8 demonstrates that the optimum range for the PC-12 aircraft must be less than 600 Nautical miles. For airports unserved by commercial airlines or inaccessible with medium-sized jet aircraft due to a short runway, the PC-12 can still be a viable option even for longer route segments. For short routes under 200 Nm, literature suggested other substitutes like trains and

[3] One Nautical mile = 1,852 kilometres (International Bureau of Weights and Measures, 2006).

cars offer a competitive advantage against air travel. This analysis is in line with the literature review suggesting the optimum route length for the PC-12 is under 500 Nm, even somewhere around 250 Nm.

Table 8. Comparison of flight times and costs for different aircraft types based on mission ranges. Note: data compiled from bcadigital.com (2016) and Roch (2016).

Aircraft type	Seating capacity	Hourly rates[1]	Flight time[2] / cost		
			300 Nm	600 Nm	1000 Nm
PC-12 NG	9	2200 € / h	1:10 / 2567 €	2:16 / 4987€	3:46 / 8287 €
Citation Mustang	5	2400 € / h	1:00 / 2400 €	1:56 / 4640 €	3:19 / 7960 €
Phenom 300	7	3500 € / h	0:46 / 2683 €	1:27 / 5075 €	2:23 / 8342 €
Citation Excel	9	4000 € / h	0:46 / 3067 €	1:29 / 5933 €	2:26 / 9733 €
[1] Hourly rate estimates based on expert interview (Roch, 2016). [2] Flight times compiled from "Purchase Planning Handbook" available at bcadigital.com (2016).					

Cordova (2016) claimed in an interview that "the PC-12 is a very good aircraft for short distance up to 400 or 500 miles". He continued by stating that it becomes slow when compared to jets on longer routes and that the jet might eventually become cheaper as it travels faster. Additionally, Viro (2016) and Belidis (2016) note in independent interviews that the aircraft is not competitive for flights longer than 2 hours. Ten industry experts familiar with the PC-12 aircraft took part in an online survey and were asked what they consider is the most competitive air travel distance for this aircraft. The multiple answer choices where: less than 100Nm; 100-300Nm; 300-500Nm; 500-800Nm; 800-1200Nm; and more than 1200Nm. Eight out of ten (80%) answered the optimum range to be 300-500Nm, while one considered the optimum range to be 100-300Nm and another considered it to be 500-800Nm. Survey results strengthen the literature research, quantitative analysis and interview findings suggesting the optimum range for the PC-12 aircraft is short, somewhere in the range between 200 and 500 Nautical miles.

Conclusion: The business model should utilise the aircraft optimum route length, which ranges from 200 to 500 Nautical miles.

The literature research in sub-section 3.2.3 suggested that a point-to-point route network with a strong presence at the home base is recommended due to saved travel time and economies of scale. Evans (2016) supports this standpoint by stating that the PC-12 aircraft "sits nicely in an underserved or poorly served environment with a point-to-point route structure". He continued by arguing that the downside of using a PC-12 in a hub is that you need a lot of these aircraft to make an impact and you often end up competing with more operators. Wickart (2016) adds that the benefit with the PC-12 is that you can offer direct point-to-point service in markets where other operators don't have enough scale to profitably operate. On the contrary, Evans (2016) considers the hub-and-spoke system to be viable with the PC-12 if focusing the business model on connecting first and business class passengers travelling with commercial airlines. Wickart (2016) argues that the benefits of a hub-and-spoke system is that more city pairs are created and a better connected network is build when compared to direct flights only. However, like Evans, he also argues that the PC-12 is mainly suitable for a hub-and-spoke system in a concept where you do connecting services for airlines. This kind of business model is essentially a point-to-point service for the PC-12 operator even though it connects to a larger hub-and-spoke system.

The literature recommendation to operate PC-12 aircraft with a point-to-point route structure seems to be supported by interviewees with both operational and business expertise. The additional finding from interviews is that the PC-12 could succeed as a feeder aircraft for the high-end segment of travellers by utilising a hub-and-spoke system together with large airlines.

Conclusion: The business model should utilise a point-to-point route network or connect with large airlines in a hub-and-spoke system.

4.2.3 Airport Base and Operating Region

This sub-section aims at answering what airport base and region to operate in. The airport base and operating region decisions are based on a theory driven interview analysis. Interview patterns and repetitive claims are looked for to find solutions. Reliability and support for individual arguments is achieved through the categories of expert groups presented in table 7.

A literature study in sub-section 3.2.2 concluded that it is viable for PC-12 operators to look for easily accessible and less congested secondary or regional airports with a high situational demand. Interview findings support this recommendation since experts with operational expertise also recommended to search for less congested secondary or regional airports with shorter runways (Auterinen, 2016; Wickart, 2016; Roch, 2016). Evans (2016) states that “the aircraft lends itself beautifully to unserved or very poorly served second-tier airports”. Also, one of the PC-12 aircraft strengths presented in sub-section 4.2.1 was its good short field performance. PC-12 pilots consider an approximately 1000-metre runway length to be sufficient for the aircraft to land and take-off depending on payload and conditions (Korkelainen, 2016; Viro, 2016; Aalto, 2016).

Interviewees where asked what they consider are some of the minimum airport infrastructure and equipment requirements for operating PC-12 aircraft. Cordova (2016) claims the PC-12 won’t require much infrastructure to operate, only a tarmac or grass field is sufficient. Auterinen (2016) recommends a simple towing solution and some de-icing equipment should be available at the operator’s home base. Cordova (2016) and Korkelainen (2016) both notes an EASA AOC puts some minimum requirements for firefighting and rescue services needed at the airport when operating commercial flights. Korkelainen (2016) concludes that airport equipment requirements for the PC-12 are overall lower than for many rival aircraft.

Cordova (2016) stated in an interview that “if you want to improve chances to land in low weather conditions then you need as a minimum an instrument approach procedure at the airfield”. Chapter 2 presumed the recommended PC-12 business model needs to have an all-weather capability and therefore the airfield needs to have an instrument approach procedure to use in reduced visibility. New advanced GPS approach procedures are increasing in Europe and both Auterinen (2016) and Viro (2016) notes these GPS procedures are sufficient for the PC-12 and no ground based equipment is needed for approach navigation. Fabio Gamba, the CEO of EBAA pointed out in an online article that they are focusing to open more airfields for these satellite-based approaches in Europe (Sheppard, 2016).

Five of the interviewees independently raised their concern about the importance of a maintenance facility close to your home base (Lawlor, 2016; Belidis, 2016; Lees, 2016; Roch, 2016; Korkelainen, 2016). Lawlor (2016) claims the direct costs are high if you must fly significant distances to get the aircraft maintained. Additionally, indirect costs in the form of lost revenue will occur in case maintenance and parts are a long time away from your base airport once the aircraft gets grounded due to a technical fault (Lawlor, 2016). Belidis (2016) argues it is very expensive to fly an engineer to the aircraft base from abroad to do maintenance and thus recommends considering this when starting operations. Roch (2016) notes maintenance availability is especially important for this aircraft as the basic maintenance interval is 100 flight hours. Lees (2016) points out that so called satellite service centres are readily available for example in Germany and notes that it is a huge investment for an operator to set up an own maintenance facility. Therefore, he urges new companies to look for established service centres. Pilatus has published a list of available satellite service centres around the world, which reveals there are maintenance facilities available in Germany, France, Switzerland, Poland, UK, Czech Republic, Denmark, Spain and the Netherlands (Pilatus, 2016b).

Based on literature research in sub-section 3.2.2 and expert interview findings in this sub-section, below is a compiled list of important attributes to consider when selecting a base airfield for PC-12 operations:

- landing rights available (no slot restrictions);
- low landing fees;
- easy accessibility;
- high situational demand;
- uncongested and smooth security;
- an instrument approach procedure available (e.g. GPS based procedure);
- availability of basic ground equipment (e.g. fuelling, towing and de-icing);
- rescue and firefighting readiness based on operator approval; and
- a Pilatus PC-12 maintenance facility nearby.

These recommendations are not important for destination airfields in charter operations since the basis is to operate where the customer wants to fly once it fulfils authority and operator safety requirements.

Conclusion: Look for easily accessible and less congested secondary or regional airports with a high situational demand.

Seven interviewees where asked in what parts of Europe they believe the demand for commercial PC-12 flights would be highest. The countries that reoccurred most in interviewee answers where:

- **France** (Cordova, 2016; Auterinen, 2016; Roch, 2016; Lawlor, 2016);
- **Germany** (Cordova, 2016; Wickart, 2016; Auterinen, 2016; Lawlor, 2016);
- **UK** (Cordova, 2016; Wickart, 2016; Auterinen, 2016; Roch, 2016); and
- **Switzerland** (Auterinen, 2016; Roch, 2016; Krohn, 2016).

Cordova (2016) claims countries with a high density of small airports and minor cities with a lot of isolated industry pools will have a high demand for PC-12 operations. Similarly, Viro (2016) considers the demand would be highest in populated areas with large congested airports nearby. Wickart (2016) suggests that it is viable to aim at regions with much distributed wealth and where you can connect rural industry hubs with the cities people travel to. He also notes that UK is more probable to adapt to luxuries like private flying. Lawlor (2016) would aim at connecting city pairs where people are travelling both for business and leisure. Wickart (2016) also see potential to operate the PC-12 to popular leisure destinations like St. Moritz and Saint Tropez to name a few. Auterinen (2016) claims it would be beneficial to aim at countries where business aviation is well established. From a list of recommended countries, he considers Germany is most competitive while UK and southern France remains less price sensitive. Roch (2016) points out that countries where the King Air has been successful, like Switzerland, France and Germany, people are more likely to adapt turboprops. Krohn (2016) considers the PC-12 being suitable for high terrain areas where the aircraft performance gives a competitive advantage.

Interviewee opinions presented above are a mix of arguments from both operational and business experts. Repetitive interview claims signal it to be most viable to aim at wealthy countries with many small airports, isolated industries, a well-established business aviation sector and a high population. Repeatedly suggested countries and those matching the criteria above include; France, Germany, UK and Switzerland.

Conclusion: Operate in wealthy countries and regions with a high density of population, small airports and rural industries like; France, Germany, UK and Switzerland.

When deciding on where the operator base should be established it is relevant to analyse how the regulatory scene might vary from one country to another. However, in Europe it is possible to operate within foreign countries while the regulator depends on the operator's home state. Some of the European countries gave derogations to SET-IMC operational approvals before adapted by all EASA countries, and it is expected that these countries are more supportive for the new regulations. Industry experts say Finland and France are amongst the forerunners in the SET-IMC regulations and are one step ahead now that the new regulations are implemented (Cordova, 2016; Korkelainen, 2016; Lees 2016). The United Kingdom is recognised as the country that was initially most against commercial SET-IMC operations, but their national civil aviation regulator has recently supported the new regulations (Aalto, 2016; Auterinen, 2016; Korkelainen, 2016; Lees, 2016). The German Civil Aviation Authority (Luftfahrt-Bundesamt) was against the new regulatory change, which is contrary to common sense, because in Germany SET aircraft are common in the private sector where regulations are less strict (Korkelainen, 2016; Lees, 2016). Cordova (2016) stated in an interview he is concerned EASA regulations are subject to state interpretation. He explains that “different states will have a different interpretation on the text and they will apply the regulation in different ways”.

4.2.4 Type of Operations and Fleet Size

This sub-section aims at answering what type of operations to conduct and with what fleet size. These choices are based on theory-driven interview analysis and quantitative survey data. The method used is comparison of interview findings with literature to find support for theory presumptions. Reliability and support for individual arguments is achieved through the categories of expert groups introduced in table 7. The operational decision begins by analysing the achievable utilisation rate of the PC-12 and whether scheduled or on-demand operations is more suitable for this aircraft. Additionally, a solution for developing a service that provides flexibility of on-demand flights and the cost benefits of scheduled flights as recommended in chapter 3.2.4 is looked for.

Ten industry professionals were asked in a survey what they consider is the highest operationally achievable yearly utilisation rate for commercial operations with the Pilatus PC-12 without taking demand into consideration. The results were as following:

- 800 to 1200 hours – 1 vote (10%);
- 1200 to 1600 hours – 2 votes (20%);
- 1600 to 2400 hours – 4 votes (40%); and
- More than 2400 hours – 2 votes (20%).

Choices between zero and eight hundred gathered no votes and one interviewee had no opinion (refer to Appendix A question 3). Results indicate the PC-12 can be utilised more than charter aircraft are utilized on an average, since charter aircraft are normally used between 600 and 1200 hours a year as cited in section 2.2. However, the characteristics of charter operations make it hard to utilise one aircraft more than 1200 hours per year due to the various constraints presented in sub-section 3.2.4. On the other hand, literature suggests on-demand operations is not constrained at this utilisation rate. In the US where air taxi operations have existed longer, the FAA has estimated that air taxi operators can achieve around 1500 revenue hours per aircraft annually (Tripsas et al., 2009). Cordova (2016) stated in an interview that he has calculated the theoretical maximum utilisation rate for this aircraft to be 2650 hours per year. This figure considers full aircraft utilisation during day time and accounts for certain maintenance and other restrictions. Evans (2016) states that 2000 hours per year can be achieved with the PC-12 aircraft in scheduled operations.

Lees (2016), who is familiar with the PC-12 maintenance requirements, estimates that a typical maintenance facility must work 3 days on the aircraft for every 100-hour inspection and 6 to 7 days on the aircraft annual inspection. He adds that the work can be performed even faster when required, but this would require dedicated work force and highly developed procedures. With the typical restrictions in place, the aircraft would be grounded for maintenance 67 days per year with a 2000-hour utilisation rate and 43 days per year with a 1200-hour utilisation rate. This means that to achieve 1200 hours of flight time for one aircraft per year in charter operations the aircraft would need to be airborne 3.7 hours per day during days not grounded for maintenance. Eurocontrol statistics reveal the average sector length for chartered business flights in Europe is 105 minutes (Booz Allen Hamilton, 2016). This means that more than two of these average length flights needs to be flown per day to achieve 1200 hours in charter operations annually. Respectively, approximately 6.7 hours of flight time per day would be required to achieve a 2000-hour yearly utilization rate in scheduled flight operations considering the maintenance restriction. For example, with an average scheduled route length around 300 Nm (70 min flight time as per table 8), approximately 6 sectors would need to be flown per day to achieve 2000 hours in scheduled operations annually. Operational experts and PC-12 pilots where asked how long it takes for the aircraft to turn around on ground before a new flight and estimates ranged between 10 and 20 minutes in case full ground support is provided. With fuelling the minimum is estimated to be between 30 and 40 minutes. (Cordova, 2016; Lees, 2016; Korkelainen, 2016; Viro, 2016). Additional time is spent for taxiing in and out, however, taxi times can be estimated short if small secondary or regional airports are used. Table 9 presents a typical flight schedule that could be used to achieve 2000 yearly flight hours.

Table 9. Example of a daily schedule for a PC-12 aircraft targeting 2000 yearly hours on a 300 Nm route. Note: short taxi times and refuelling every two sectors assumed.

Sector	Taxi out	Flight time	Taxi in	Ground time	Total	Departure
1. A to B	5 min	70 min	5 min	20 min	100 min	7:00 am
2. B to A	5 min	70 min	5 min	40 min	120 min	8:40 am
3. A to B	5 min	70 min	5 min	20 min	100 min	10:40 am
4. B to A	5 min	70 min	5 min	40 min	120 min	4:00 pm
5. A to B	5 min	70 min	5 min	20 min	100 min	6:00 pm
6. B to A	5 min	70 min	5 min	-	80 min	7:40 pm

Based on the analysis above we can conclude that 1200 flight hours per year is a high but achievable aircraft utilization rate for on-demand operations with the PC-12 aircraft. Similarly, research suggests a higher aircraft utilization rate of around 2000 hours per year can be achieved in scheduled operations.

Conclusion: Aim at high aircraft utilisation around 1200 hours per year for on-demand operations and around 2000 hours for scheduled operations.

Interviewees from the business expert group where asked what the advantages are for scheduled and on-demand operations with the PC-12 and below is a list of mentioned benefits for scheduled operations:

- Support resources available more cost effectively (Evans, 2016);
- Possibility to share the aircraft (Wickart, 2016);
- Lower operating cost with higher utilization rates (Belidis, 2016; Lawlor, 2016);
- Avoiding empty legs (Auterinen, 2016; Lees, 2016); and
- Possibility to replace commuter aircraft on narrow routes (Auterinen, 2016).

The reoccurring benefits of on-demand operations was the flexibility of schedule and destination (Evans, 2016; Wickart, 2016; Auterinen, 2016). Evans (2016) argues “the most significant problem with on-demand is that it can go anywhere anytime making it difficult to have resources in the right place resulting in high operating costs”. Wickart (2016) notes that if you sell individual seats on scheduled flights, you will have a lower entry level price and can expand the target audience to a lower-income, and hence larger demographics which makes your accessible market significantly larger. He also states that the customers in the higher end segment looking for luxury will go for more expensive aircraft rather than the PC-12.

Interviewees where asked whether they find it possible for on-demand operators to sell tickets per seat instead of renting the whole aircraft. Wickart (2016) suggests one way would be to incentivize the first person to get a cheap ticket if he can find the next three to six persons subsidising his flight. However, he continues by explaining it must be clear for the customer that unless the next three or four people are found you will not fly, otherwise it is not economically feasible. Belidis (2016) notes that the value added of a private flight is lost if you start sharing the flight. However, with a large fleet he considers both offerings can be made available. Krohn (2016) who has worked as a manager in the business aviation broker market consider a significant number or clients would be ready to share their seats on charter flights.

Interestingly many of the interviewees find the PC-12 aircraft suitable for serving as a feeder for first and business class passengers travelling with larger commercial airlines (Auterinen, 2016; Lawlor, 2016; Wickart, 2016; Belidis, 2016). Wickart (2016) summarises the advantages for the consumer using PC-12 as a feeder aircraft to be; increased travel privacy, a faster connection and a connection closer to the destination as the PC-12 can get into smaller airports.

Business and operational experts where asked how many aircraft is the minimum viable fleet size for PC-12 operations. Lawlor (2016) finds it important to start with a minimum of two aircraft or more, otherwise it won't be possible to operate 365 days a year due to aircraft maintenance and disruptions. Wickart (2016) argues that a third aircraft is essential in scheduled operations to serve one city pair with bidirectional traffic. Without bidirectional traffic, he states that "you will have full legs going out and empty legs coming back in the morning and vice versa in the evening". Two aircraft can serve both directions during peak hours and the third aircraft is used as a spare. With more city pairs the spare aircraft can be used for a larger fleet, for example every tenth aircraft could be a spare to save costs. Evans (2016) claims around six aircraft is needed before you get some economics of scale. He further notes that one aircraft could be operated viable on its own through outsourcing.

Overall, interviewees seemed to support the use of PC-12 aircraft in scheduled operations due to cost benefits. However, it remains important that the passengers achieve time savings, otherwise the biggest value added presented in sub-section 3.2.6 is lost. An interesting operational model proposed in an interview is a hybrid model where the aircraft is used in scheduled operations during peak hours between popular city pairs and for on-demand charter during weekends and non-peak hours (Wickart, 2016).

Conclusion: Operate scheduled flights with a minimum of three aircraft. Increase utilisation rates and revenue by feeding airlines and/or offering on-demand flights during non-peak hours.

Sections 4.7 and 4.9 will further analyse how distribution channels and pricing models could increase passenger flexibility for scheduled flights as recommended in sub-section 3.2.4. Additionally, even though most of the interviews indicated the economics are in favour of scheduled flights there remains a niche market for on-demand operations from airports with short runways (Roch, 2016). Therefore, both on-demand and scheduled operations are further analysed through profitability analysis in sub-section 4.9.

4.2.5 Section Conclusion

This section focused at developing the key activities in a business model for operating PC-12 aircraft in Europe. The SWOT analysis in section 4.2.1 served as a basis for further analysing literature, interview opinions and survey results to answer the sub-questions related to key activities. Based on research the recommended business model key activities are as following:

- Utilise an optimum route length ranging from 200 Nm to 500 Nm;
- Use a point-to-point route network or connect with large airlines in a hub-and-spoke system;
- Look for easily accessible and less congested secondary or regional airports with a high situational demand;
- Operate in wealthy countries and regions with a high density of population, small airports and rural industries like France, Germany, UK and Switzerland;
- Aim at high and achievable utilisation rates around 1200 hours per year for on-demand operations and around 2000 hours for scheduled operations;
- Operate scheduled flights with a minimum of three aircraft. Increase utilisation rates and revenue by feeding airlines and/or offering on-demand flights during non-peak hours.

This section showed the PC-12 provides a lot of strengths that could prove to be successful when competing with existing business models. More importantly, it offers features that could help new customer segments adapt to the usage of business aircraft. The main driver for introducing this kind of business model for new customer segments would be the low operating costs enabling offerings at a new price point.

4.3 Value Proposition

This section aims at answering what should be the main value propositions for the business model. Literature analysis in sub-section 3.2.6 described the overall value propositions in business aviation. Findings are further analysed through a deductive survey and through simple case analysis. The survey results are scored and ranked to indicate importance.

The most important value propositions of business aviation based on literature analysis presented in sub-section 3.2.6 are; saved travel time, the ability to use airports that airlines don’t serve and a higher travel productivity. These value propositions are generic for all business aviation aircraft. When developing a business model it is relevant to analyse whether these value propositions are valid for this specific aircraft. In a survey conducted for this thesis, ten industry experts familiar with the PC-12 aircraft where asked to rank nine often cited customer value propositions listed in sub-section 3.2.6 based on their perceived importance for the customer when using PC-12 aircraft. The results are shown in table 10 below where a higher score signals higher importance. Refer to Appendix A question 1 for detailed survey results.

Table 10. Survey results on PC-12 value propositions ranked based on perceived importance for customers. Note: average score 4.8 and standard deviation 2.0.

Value propositions	Score
1. Saved travel time	7.8
2. Flexible schedules	7.1
3. Less hassle and travel delays at congested airports	6.5
4. Ability to use airports that airlines don't serve	6.4
5. Cost savings	4.5
7. Increased travel privacy	4.1
6. Increased travel comfort	3.9
8. Allows for higher productivity during travel	3.4
9. Higher perceived safety and security	1.3

Survey results shows that the PC-12 value propositions partly merge with the general value propositions of business aviation. Value propositions ranked highest by experts for PC-12 operations are:

1. Saved travel time;
2. Flexible schedules;
3. Less hassle and travel delays at congested airports; and
4. Ability to use airports that airlines don't serve.

The selected key activities in section 4.2 are partly supported by the value propositions above.

Conclusion: The business model needs to accomplish and communicate the most important customer value propositions being; saved travel time, flexible schedules, hassle-free less delayed travel and the ability to use airports that airlines don't serve.

To analyse how the most important customer value proposition holds for a PC-12 flight, table 11 summarises a typical example of travel times for a team of six persons travelling between Paris and Geneva (255 Nm). Business aircraft often depart from airports closer to the city centre when compared to airlines that depart from large international airports further away. Booz Allen Hamilton Inc. (2016) study points out that time savings around Paris are particularly prominent since the largest commercial airport, Charles de Gaulle, is located far away from the city centre when compared to business aviation airport Le Bourget. The hypothetic analysis in table 11 reviles that a PC-12 flight can save significant time when compared to the second-best alternative. Another interesting finding is that a PC-12 flight can be cost effective for a group of six persons when compared to commercial airline business class tickets. The third thing to note from table 11 is that trains between large cities in Europe are relatively fast and serve as a viable option for flying. It is recommended that any planned PC-12 business model considers train travel as a serious substitute since it is a commonly accepted even for wealthier individuals to travel by train in Europe.

Table 11. Comparison of a one-way trip from Paris to Geneva (255 nautical miles). Note: Compiled data from rome2rio.com and interview data (Roch, 2016).

Once way travel times	PC-12 flight	Airline	Train	Driving
Taxi to airport or train station[1]	15 min	30 min	15 min	-
Parking / Security / Check-in	15 min	45 min	5 min	-
Wait at gate	-	30 min	-	
Flight / train / driving time	1 h 10 min	1 h 10 min	3 h 14 min	5 h 3 min
Airplane taxi time	10 min	20 min	-	-
Time to meeting location	10 min	10 min	10 min	-
Total travel time	**2 h**	**3 h 25 min**	**3h 44 min**	**5 h 3 min**
Estimated cost (6 Pax) [2]	**2594 €**[3]	**1460 € (Economy)**[4] **2972 € (Business)**[4]	**578 €**	**125 €**

[1] Traveller's depart from a Paris city centre office. [2] Taxi, train and driving costs estimated with internet site rome2rio.com on the 15th of December 2016. [3] PC-12 flight cost estimated based a typical rate of 2200 € per hour (Roch, 2016). [4] Airfares estimated based on AirFrance flight if booked and flown on the 15th of December 2016.

Overall, the value propositions for using business aviation and PC-12 aircraft seems strong and it is often wise to use business aviation instead of commercial flights. The strong value propositions are time saved by using airports close to the customer, reduced boarding time and reaching destinations that can't be reached with airlines. At the same time cost effectiveness is required to be competitive against substitutes (e.g. trains, cars and airlines).

4.4 Customer Relationship

This section aims at answering how to interact with customers in the business model by looking for patterns in literature, interviews and survey findings.

Osterwalder and Pigneur (2010) argues that customer relationships are driven by the following motivations; customer acquisition, customer retention and boosting sales. In addition, the question on how to interact with customers is also linked to service level offered. Roch (2016) states in an interview "it is interesting that nobody is focusing on bringing better quality and service to the European business aviation market". However, he also states it costs a lot to do that and other interviews suggests potential users of the PC-12 aircraft are not seeking for the ultimate luxury experience in service level. The service level question ultimately leads to the targeted customer segment analysed in the next section. In customer acquisition and retention, it is important to understand customer preferences. Krohn (2016), who is an expert in sales and marketing of chartered business aircraft, notes that customers mainly look at price and the overall "niceness" of the aircraft when booking a flight. Additionally, he argues that in terms of aircraft features, customers are mainly interested in on-board amenities or service and they rarely ask questions about aircraft safety features for example.

Sub-section 3.2.9 argued the importance of personal recognition for customer retention amongst airline business travellers. One effective way to retain customers introduced in the same sub-section is via customer loyalty programs. Industry experts answered a survey question on what they find as the most cost effective way for boosting sales in PC-12 operations out of a list of nine practices. Interestingly, the findings indicate industry experts do not recognise customer loyalty programs as a cost-effective way of boosting revenue for PC-12 operations. Instead they recognised entering a strategic partnership with other operators as the most viable choice (more on survey results in section 4.9). This could signal direct interaction with the customer through customer loyalty programs is not perceived as a priority for PC-12 operators by experts. Otherwise, interview findings and survey results are perceived too weak to draw any conclusions on how to interact with customers in this specific business model.

Conclusion: Further research on customer acquisition and customer retention is required before deciding on how to interact with the customer.

4.5 Customer Segment

This section aims at answering which customer segment to target in the business model. Literature analysis in section 2.1 suggested not to aim the PC-12 aircraft offering at the well served high-end customer market segment. This argument is further analysed through a theory-driven interview research where patterns and repetitive claims are studied to support or oppose theory.

The group of interviewees with business expertise where asked what customer segment they recommend targeting with the PC-12 aircraft in Europe. The most repeated answers were corporate segment, wealthy leisure travellers, government entities, medical evacuation clients and current first/business class travellers.

Conclusion: Customer segments to target include; corporate travellers, wealthy leisure travellers, government entities, medical evacuation clients and travellers using airline first and business class.

Krohn (2016) claims the wealthiest user searching for luxury will fly a jet instead of a propeller aircraft since they prefer faster aircraft that are perceived more luxurious. Belidis (2016) states he would target the offering both for established business aviation users and users that are not yet familiar with business aviation. He also notes that a scheduled flight alternative would make the offering reachable for less affluent individuals. Similarly, Auterinen (2016) also stated that he recommends PC-12 operators to aim at new market segments of people in the higher middle class not earlier used to business aircraft. Existing business aviation users can be attracted with a lower price point while customers currently travelling on business or first class flights may see value in time savings. Wickart (2016) notes that the problem in Europe is that the executive level often flies commercial airlines while for example in the US a much larger percentage of executives or wealthy individuals fly private. In this sense, scheduled PC-12 operations could be a stepping stone for many executives and wealthy individuals to fly more privately and comfortably. Wickart (2016) would aim scheduled PC-12 flights for people with above average income and not those with millions at their disposal. As section 4.3 showed, there is a value proposition for using PC-12 aircraft when compared to flying first or business class on larger airlines. The recommendation based on interview analysis is that the business model should target the upper middle class instead of the wealthiest individuals to increase the target audience.

Conclusion: Target the business model for individuals in the upper middle class instead of the super wealthy.

Another potentially large segment of customers could be found among users currently relying on private aviation in the form of own or corporate jets and fractional ownership programs. Research findings from interviews in this thesis do not consider these user segments and further research is required to confirm their potential.

4.6 Key Resources

This section aims at answering what the key resources of the business model are. Instead of concentrating on the key resources introduced by literature in sub-section 3.2.7 the interviews analysis is conducted with an inductive approach. In this section, repetitive interview answers are given more value.

Twelve interviewees where asked what they consider are the key resources for a successful PC-12 business and the most popular answers where:

- **Availability of maintenance** (Wickart, 2016; Korkelainen, 2016 Lawlor, 2016; Belidis, 2016; Lees, 2016; Roch, 2016; Cordova, 2016);
- **Experienced pilots** (Evans, 2016; Auterinen, 2016; Belidis, 2016; Lawlor, 2016; Aalto, 2016);
- **The right employees** (Auterinen, 2016; Belidis, 2016; Korkelainen, 2016; Lawlor, 2016; Aalto, 2016); and
- **A robust business model** (Lawlor, 2016; Belidis, 2016).

The most significant finding is that seven of the interviewees independently raised their concern about the importance of a maintenance facility close to the operator's home base. The challenge with business aviation aircraft is that they are often based at small regional airports and can't use centralised maintenance facilities located at larger airports. Particularly in charter operations the take-offs and flight hours might be hard to predict and therefore it might be hard to pre-schedule maintenance. Wickart (2016) notes one challenge is that Pilatus is not yet an OEM like Textron or Embraer and they do not yet have the density of spare parts and authorised maintenance centres needed. Linked to maintenance, "power by the hour" solutions for the engine and avionics were listed as an important resource by three interviewees (Evans, 2016; Lees, 2016, Auterinen, 2016).

The right employees were mentioned several times as an important resource and the availability of experienced pilots was separately brought up during several interviews. Both findings can be perceived significant due to their repetitive nature. Auterinen (2016) states a skilled, multi-talented and enthusiastic workforce is the key in successful PC-12 operations. He notes the back office must be small and flexible to keep costs down and stay up to date in a dynamic marked. Viro (2016) notes many of the managerial positions must be combined with a pilot's role to be cost efficient. This may be one reason the availability of experienced pilots was raised as a concern by so many interviewees. Also, business aviation and particularly single engine aircraft are generally not perceived attractive by the pilot community.

Belidis (2016) stated one important resource for success is a good business model. He reasons that "the business model needs to be sharp and have a very good sales and marketing plan in place and you should have done your financial studies". Other individually mentioned resources perceived significant as per expert opinion are pilot training (Viro, 2016), critical mass of customers (Cordova, 2016), company internal procedures (Aalto, 2016) and a no blame culture (Auterinen, 2016).

Conclusion: The key resources for successful PC-12 operations are; availability of maintenance, experienced pilots, the right employees and a robust business model.

Due to its significance we will examine employee and pilot availability in more detail. First, operational experts where asked how many pilots and managers are sufficient for operating one PC-12 aircraft. In charter operations, the answers for number of pilots ranged from three to four pilots per aircraft, two of which must be captains (Viro, 2016; Aalto, 2016; Lees, 2016; Auterinen, 2016). In scheduled operations, the answers ranged from six to nine pilots depending on schedule and aircraft utilisation rates (Aalto, 2016; Cordova, 2016; Lees, 2016; Evans, 2016; Auterinen, 2016). The minimum number of managerial positions for commercial air operators in Europe is eight. Each company must nominate an accountable manager, a head of flight operations, a head of training, a compliance manager, a safety manager, a continuous airworthiness manager, a ground operations manager and a security manager (Lees, 2016). By combining some of these roles a minimum of four persons must be hired in small non-complex organisations like the proposed business model represents (Ibid.).

Secondly, some interviewees with piloting experience where asked what they estimate current pilot salaries to be for PC-12 pilots in Europe. First officer salaries were estimated to be two to three thousand euros a month and captain salaries between four and five thousand euros a month while instructors and examiners get roughly 20 percent more. (Aalto, 2016; Cordova, 2016). Cordova (2016) notes he has heard PC-12 pilots earn up to nine thousand euros per month in Europe.

Finally, experts where asked how they think pilots can be attracted to fly PC-12 aircraft and to business aviation in general. Evans (2016) claims a perception change of single engine aircraft is needed for pilots to look at it more favourably. Lawlor (2016) notes that a good compensation and bonus structure needs to be put in place. Cordova (2016) emphasises the importance of a strong career plan for pilots, otherwise experienced pilots will go and fly for larger airlines. He also states that "since you are flying to many small places with not much to do and the schedule is less attractive, you need to compensate that either by an increased pay, more days off or something similar". Lees (2016) argues that the work schedule for pilots can be attractive in companies engaged in scheduled PC-12 operations as a typical scheduled PC-12 operation would allow pilots to spend each night at home. Korkelainen (2016) recommends operators to market the business aviation industry to pilots as one with more diversity, excitement and challenging flight missions.

4.7 Distribution Channel

This section aims at answering what the best sales and marketing channels are for the business model at hand. Literature analysis in sub-section 3.2.9 showed that the broker firms constitute a large share of business aviation's overall distribution channel. Whether the same distribution channels are feasible for PC-12 operations is examined in this chapter through an interview analysis looking for patterns and repetitive claims backed up by sales and marketing experts.

The most significant interview outcome was that internet-based sales and marketing channels are perceived most popular by the interviewees. Belidis (2016) estimates the market is moving online and he believes less in advertisement on magazines and publications. Evans (2016) finds it important to use applications and other internet based services, because clients benefit from the easiness of booking, cancelling and changing flights in real time through these services. Wickart (2016) perceives digital channels best because it is easier to attract attention, "the cost per impression is very low and you can target and measure it well". Krohn (2016) claims you need to be visible on online search engines when clients look for flights to book. An interesting point raised by Krohn (2016) is that tickets for scheduled flights can't be sold by a broker firms since they would need to register as a travel agent. Online applications were suggested to be used for tracking demand and for asking people where they prefer to fly beforehand. This way you gather a critical mass of clients before starting a new flight route.

Conclusion: Invest in online sales and marketing channels. Utilise mobile applications to manage bookings and track demand.

Other sales and marketing channels suggested by experts were direct contact with potential customers (Krohn, 2016; Belidis, 2016), attending network events (Belidis, 2016) and partnering with airlines (Wickart, 2016).

4.8 Cost Structure

This section aims at answering the question on what the operational costs are for running PC-12 operations and how to cut cost. The research method used combines expert interview analysis with collected data on operational costs from various sources such as internet sources and expert opinion. A cost comparison between two different business model options, namely on-demand charter and scheduled operations is introduced in this section. Additionally, survey results on how experts think cost can be cut is presented last in this section.

Lees (2016) states that the PC-12 aircraft can be economically very profitable with high utilisation rates and that a high utilisation rate is relatively more important when compared to other aircraft alternatives. Lawlor (2016) argues the PC-12 aircraft business model becomes cost effective with utilisation rates between 800 and 1200 hours per year in charter operations. Roch (2016) claims the seating capacity versus price makes the PC-12 highly competitive. He also notes it is possibility to convert the aircraft to a utility aircraft giving it a second life in cargo or medical evacuation operations.

Interviewees belonging to the group of business experts were asked what they estimate the direct operating costs (DOC) for a PC-12 aircraft to be. Roch (2016) and Lees (2016) estimates the direct operating costs to be roughly 600 euros per hour, including maintenance and fuel consumption. Roch (2016) states the direct operating costs are higher for old legacy PC-12, around nine hundred euros. Experts estimate the navigation fees in Europe to be around one hundred euros per hour on an average (Roch, 2016; Auterinen, 2016). Estimates are in line with statistics showing average navigation fees in Europe were 94.69 euros per hour in 2013 (EBAA, 2014). Landing and handling fees depend highly on whether you use major airports or smaller regional airports. Roch (2016) would estimate the average landing and handling fees in Europe to be around 350 euros per flight in on-demand operations. Lees (2016) notes that a scheduled operator would get significantly lower landing and handling fees at frequently operated stations, estimated at 100 euros per landing. Lawlor (2016) notes the efficient management of the business's fixed costs significantly affects the overall effectiveness of the business. He argues that, where regulatory approval is possible, combining managerial roles, so that one individual takes two roles, a higher effectiveness can be achieved without compromising on quality and safety.

Experts were asked what makes the PC-12 aircraft a good or bad financial investment. Six interviewees with business expertise independently claim a high residual value of the PC-12 aircraft helps to make it a good financial investment (Wickart, 2016; Lawlor, 2016; Evans, 2016; Belidis, 2016; Auterinen, 2016, Roch, 2016). Lawlor (2016) states that the residual value is likely to be higher for an aircraft that is both operated and maintained correctly. Roch (2016) notes the aircraft depreciation will be highest during the first years and thus considers it better to buy used aircraft. He continues by stating that the depreciation basically stops at 2 million euros since it is difficult to find a PC-12 aircraft on the market under this price regardless of the aircraft age. Auterinen (2016) states that an aircraft is always easy to sell since the asset can be used anywhere in the world. Based on historical statistics the PC-12 has held 75 percent of its initial value after 5 years (Pilatus, 2013). This figure is in line with opinions gathered in expert interviews. A PC-12 NG aircraft costs around 4.7 million USD and Lees (2016) estimates that an 8-year-old aircraft can be resold between 3.2 million and 3.4 million USD. Roch (2015) recommends to use a six percent depreciation rate for new PC-12 NG aircraft. Combining statistics and interview findings this 6 percent depreciation rate seems reliable and is used in further cost analysis.

Five interviewees independently said that they consider it hard to find leasing or debt finance for the PC-12 (Wickart, 2016; Lees, 2016; Roch 2016; Evans, 2016; Lawlor, 2016). Lees (2016) considers the reason to be that financiers use the same amount of work to finance a relatively cheap PC-12 aircraft as they would use to financing more expensive jet aircraft making financing arrangement costs disproportionate to the returns of a lease. Wickart (2016) notes that financiers are not very comfortable with the residual value, "since the aircraft – as one of the newest in its class – has a significantly shorter residual value data history as for example a King Air or a Citation". He states that if you are confident with the residual value of the aircraft it makes sense to own it instead of leasing it as "residual value studies of the PC-12 since its inception shows that the aircraft is strongly outperforming both aforementioned competing models in terms of actual realized residual value over time". Wickart (2016) considers that "this is due to very careful production output and second hand market management of the OEM, ensuring supply and demand stay in a sustainable equilibrium". Lees (2016) considers that leasing is a viable option in case you can find a reasonably priced lease agreement. Lawlor (2016) points out it is not optimal for a start-up company to "be at the mercy of first line creditors such as banks and financiers" since it may take the business more time than expected before generating sufficient revenue to pay financing costs. He notes that once a business has achieved steady cash flow and is in position to order more aircraft then debt finance becomes a more compelling option. Evans (2016) argues that "the big advantage with leasing is not having to lay of that big amount of capital and therefore retaining cash to work with growth of the business, while the negative is that there is a premium on a lease".

Since leasing and bank financing are hard to come across, it is hard to estimate the average cost of capital for a PC-12 aircraft. A conservative way to estimate the cost of capital without knowing whether to lease or buy the aircraft is to use the estimated WACC of 7.5 percent as presented in sub-section 3.2.10. Below is an estimate of the ownership costs of a new PC-12 NG aircraft worth 4.6 million euros based on the above estimates:

Depreciation (per year): 6% of 4.600,000 euros = 276,000 euros
Cost of Capital (per year): 7,5% of 4.600,000 euros = 345,0000 euros
Total ownership cost (per year): 276,000 euros + 345,000 euros = 621,000 euros
Total ownership cost per month: 51,750 euros

The preceding estimates are consistent with the monthly leasing prices industry experts estimate between 40 000 USD and 60 000 USD for PC-12 aircraft in Europe (Auterinen, 2016; Lees, 2016). Roch (2016) points out that the depreciation rates of used PC-12 aircraft are substantially lower making it viable to buy used aircraft.

Table 11 compares hypothetical operating costs of on-demand charter and scheduled operations for a fleet of three PC-12 aircraft. Yearly utilisation is based on achievable rates as estimated in sub-section 4.2.4. The number of sectors are based on an average route length of 105 minutes for charter operations and 70 minutes for scheduled operations (refer to sub-section 4.2.4). Salary cost estimates base on four pilots per aircraft (two captains + two co-pilots) for on-demand charter and eight pilots per aircraft (four captains + four co-pilots) for scheduled operations (refer to section 4.6). In both examples one manager per aircraft is considered sufficient as pilots are expected to take part in administrative tasks. Additionally, two administrative employees are needed for operational tasks like flight planning, flight control and customer support (Lees, 2016). For a larger fleet the number of office employees required does not increase in equivalent numbers. Based on literature and interview data, captain and manager salaries are estimated to be 5,000 euros, while co-pilot and administrative employee salaries to be 3,000 euros per month. According to Eurostat statistics the non-wage cost for workforce in Europe averaged at 26 percent (Eurostat, 2016). This percentage is added on top of wages when calculating the total cost of labour. Lees (2016) estimates the yearly training cost of a PC-12 pilot to be around 10,000 euros. In sub-section 3.2.8 the yearly training cost of a manager or administrative employee was estimated at 3,500 euros. Annual aircraft maintenance, not considered in the direct operating costs, is estimated to be around 25,000 euros per aircraft (Lees, 2016).

Table 11. Cost comparison of on-demand and scheduled operations with three PC-12 aircraft. Note: Compiled data from thesis findings and Conklin & de Decker (2016) cost evaluator.

Cost sources	Unit costs	On-demand charter[1]	Scheduled operations[2]
Trip Cost			
Direct operating costs (DOC)[3]	600 € / hour	2.160,000 €	3.600,000 €
Navigation fees	100 € / hour	360,000 €	600,000 €
Landing and handling fees	350 € / landing (on-demand) 100 € / landing (scheduled)	720,300 €	514,200 €
Fixed cost			
Insurance[4]	18,400 € / aircraft / year	55,200 €	55,200 €
Labour	75,600 € / captain; 45,360 € / co-pilot; 75,600 € / manager; and 45,360€ / administrative em-ployee / year.	1.043,280 €	1.769,040 €
Training	10,000 € / pilot; and 3,500 € / manager and ad-ministrative employee / year.	137,500 €	257,500 €
Hangar	20,520 € / aircraft / year	61,560 €	61,560 €
Miscellaneous subscriptions[5]	3280 € / aircraft / year	9,840 €	9,840 €
Refurbishing	11,900 € / aircraft / year	35,700 €	35,700 €
Annual maintenance	25,000 € / aircraft / year	75,000 €	75,000 €
Ownership cost			
Depreciation	276,000€ / aircraft / year	828,000 €	828,000€
Cost of capital	345,000€ / aircraft / year	1.035,000 €	1.035,000€
Yearly total cost (3 aircraft)		6.521,380 €	8.841,040 €
Cost per flight hour		~ 1,811 €	~ 1,474 €

[1] Assumptions for on-demand charter: 1200 yearly flight hours per aircraft; 686 yearly landings per aircraft; two captains, two co-pilots and one manager per aircraft plus two administrative employees.
[2] Assumptions for scheduled operations: 2000 yearly flight hours per aircraft; 1714 yearly landings per aircraft; four captains, four co-pilots and one manager per aircraft plus two administrative employees.
[3] Including engine maintenance, labour/parts, fuel, propeller overhaul and engine restoration.
[4] Insurance cost estimated at 0.4 percent of aircraft value.
[5] Weather service, navigation chart and maintenance program subscriptions.

The cost figures in table 11 do not consider crew accommodation and transportation since these are hard to estimate as they depend on whether the aircraft is held overnight at outer stations or not, a decision outside the scope of this thesis. Sales and marketing costs were excluded from the analysis due to their uncertain nature. Additionally, company setup costs are excluded from this thesis analysis. All cost estimates in table 11 are subject to a lot of uncertainty. Despite this, table 11 shows us how a higher aircraft utilization rate, possible in scheduled operations, lowers the average cost per flight hour. However, it is relevant to analyse the revenue side of both types of operations before making any further conclusion. Revenue is analysed in the next section.

Industry experts were asked in a survey to choose three out of ten theory driven practices they consider most viable for lowering unit costs in charter operations with the PC-12 aircraft. Alternatives were as following:

- Avoid empty legs;
- Strategic outsourcing;
- Increase aircraft utilization rates;

- Increase fleet size;
- Increase seat load factor;
- Minimise service (e.g. customer meals and on-board entertainment);
- Decrease sales and marketing budget;
- Use airports with lower landing and handling fees;
- Optimize dispatch process;
- Other (specify).

Nine out of ten (90%) interviewees consider increasing aircraft utilisation rates belongs to the top three practices for reducing unit costs. Respectively, seven out of ten (70%) consider avoiding empty legs and six out of ten (60%) consider increasing fleet size to be effective. Five out of ten (50%) responded that they recommend to use airports with lower landing and handling fees. Individual votes (10%) were given to increase the seat load factor, to tie aircraft utilisation agreements with low usage private owners ("other") and to fly legs between airports with bi-directional traffic ("other"). Rest of the alternatives gathered no support from experts. The four alternatives that gathered most votes are considered significant. Detailed survey results are found in Appendix A question 6.

Conclusion: Increase aircraft utilization rate, avoid empty legs, increase fleet size and use airports with lower landing and handling fees to cut unit costs.

4.9 Revenue Stream

This section aims at answering what the revenue streams of the planned business model are and how they can be increased. The revenue analysis starts by focusing on the pricing model decision. A revenue comparison between on-demand charter and scheduled operations is constructed and compared with the cost analysis in the last section. The main research method used analyses interview data based on patterns and repetitive claims. Support for individual argument reliability is achieved through categorization of expert groups introduced in table 7. Additionally, survey results on how professionals consider revenue can be boosted is presented last in this section.

The obvious pricing option suggested in interviews for on-demand charter is an hourly price that covers operational costs and adds a profit. Krohn (2016) argues that besides aircraft type, timing plays a key role in the hourly pricing of charter flights. This implies that customers that need to have an aircraft fast are priced higher. Roch (2016) estimates the market price for PC-12 aircraft is somewhere in the range between 2000 and 2200 euros per hour. Table 11 in the last chapter showed that the average hourly operating cost is 1811 euros. Calculations were based on a fleet of three aircraft, a high utilisation rate of 1200 hours per aircraft, 105-minute flight legs and certain other assumptions. Overall, margins seem sufficient, however, if you fly empty 20 percent of the time, then even with 2200 euros per hour for revenue legs you end up earning only 1760 euros on an average per flight hour. This shows that empty legs will significantly lower your operating income. This section assumes that the customer pays for the empty legs induced.

There are a few pricing options for scheduled flights suggested in expert interviews:

- Yield management pricing;
- Membership pricing; and
- Fixed monthly pricing.

Wickart (2016) argues the problem with yield management pricing is ending up competing with regular airlines as customers compare price directly with commercial airline ticket fares. Since the cost per seat for a small aircraft is higher than for a mid or large sized jet aircraft, the price cannot match airline competitors. The operating costs for a scheduled 250 Nm flight with the PC-12 is approximately 1,720 euros, considering certain assumptions presented in table 11. If divided between an average of six persons travelling, the operator must charge 287 euros per ticket for the flight (tax free) to cover the costs. So, a ticket around 350 euros including an operational margin seems reasonable for the added value customers gain by flying on a business aircraft. The membership pricing differs in a way that members pay a fixed price to cover capital and fixed costs plus a smaller fee per flight covering direct operating costs. As per the example in table 11, a 250 Nm flight would cost 917 euros without overhead and aircraft ownership costs considered. Divided by 6 passengers, the cost per passengers equals 153 euros. In the membership pricing model customers end up paying less for each flight, however, the customer base is reduced due to monthly or annual membership charges.

Evans (2016) argues the benefit of a fixed monthly pricing is that the operator knows each month's revenue beforehand and the customers benefit as they get a predetermined monthly price cap. He also claims there exists a benefit of not having to hire a large team for yield management and revenue optimization. Wickart (2016) claims the difficulty in a so called "all you can fly" pricing model is that peak utilisation needs to be managed as yield management is not an option. The challenge is to control that everyone does not fly at the same time. Roch (2016) notes the model introduced by a US company called Blade to give credit back to people who are committed to pay the flight when others join the flight has not been introduced in Europe yet. The main idea in this model is to sell seats on a charter flight to lower cost per passenger without endangering cash flow by flying half empty.

Table 12 examines the hypothetical revenue and profit of on-demand charter and scheduled operations with three PC-12 aircraft based on assumptions made for cost analysis in section 4.8 table 11. The revenue and profit estimates presented in table 12 are based on an hourly price for on-demand charter operations and on a fixed monthly price for scheduled operations. The revenues of different pricing models are hard to predict as this research does not explore customer's actual willingness to pay. However, table 12 calculations assume customers are prepared to spend 2,200 euros per hour for chartered flights (approximate market price as per interview findings) and a 3,000-euro monthly price for the all you can fly concept. First it is necessary to determine how many monthly priced members can be served with three aircraft operating as per scheduled model presented in section 4.8. Three aircraft each flying 1,714 flights on an average per year equals 5,142 yearly flights. The average seat utilisation in scheduled operations is estimated to be six seats per flight. This leads to an average of 30,852 available flight leg seats per year. Assuming each customer flies two flight legs per week (104 flights legs per year) it is possible to serve approximately 296 members with three aircraft per year.

Table 12. Revenue and profit comparison of on-demand and scheduled operations with three PC-12 aircraft. Note: Compiled estimates based on thesis findings.

	On-demand charter	**Scheduled operations**
Revenue driver	Sold flight hours	Number of members
Estimated sales	3600 hours	296 members
Unit revenue	2200 € / hour	3000 € / member / month
Cost[1]	6.521,380 €	8.841,040 €
Revenue	7.920,000 €	10.656,000 €
Profit	1.398,620 €	1.814,960 €
Margin	~ 17.7 %	~ 17.0 %
[1]As estimated for on-demand and scheduled operations with three aircraft in section 4.8 table 11.		

The breakdown in table 12 does not consider whether 3,000 euros is a suitable price for a monthly priced membership in Europe, whether it is possible to find almost three hundred clients for one flight route and how peak-demand would be confronted. Table 12 gives an overview of how revenue is driven in these two different business and pricing models and how much sales is required to cover the costs and leave a margin.

Neither interview analysis nor cost and revenue projections give an answer on whether on-demand or scheduled operations is more profitable and what pricing model to use for either case.

Based on interview analysis and focusing on the underlying problems with each pricing model an additional model was revealed. Interview data suggests solving the cash flow problem, control peak demand and provide flexibility similar to on-demand operations. One way to solve this would be that one charter customer books and pays the flight with the option to sell a chosen number of seats forward via an operator sales platform. Similarly to what Blade does in the US, the customer would be credited for each sold seat and eventually cover the full flight cost by selling enough seats. For example, if five or six extra seats are sold per flight leg the initial booker would travel for free. Inbuilt in the sales platform would be a bidding system where customers state their preferred destination and travel time. This helps customers initially book and pay for the flight once they know other travellers are potentially willing to subsidise the flight. The route network could be restricted to the most popular destinations to drive down cost.
The benefits with this kind of model would be that:

- routes are automatically adjusted based on demand;
- sharing economy introduced to on-demand charter;
- lower risk of empty legs;
- higher seat utilisation rate; and
- it gives initiative to book the flight early.

Once a certain route and schedule becomes popular, it could be introduced into the operator's normal schedule. The aircraft would eventually be used for scheduled operations during peak hours to destinations with high demand. Outside of scheduled hours' customers would enjoy the flexibility of chartered flights with the option to share seats and costs. The customer least flexible in flight schedule is often least price sensitive and ready to pay a premium price for the chartered option. This customer benefits from passengers willing to pay less and able to adjust as per the pre-planned schedule. From an operator perspective, the risk of not covering flight costs would diminish. Ultimately this could lead to a hybrid model were the aircraft flies scheduled routes around 2000 hours per year during peak hours and extra charter flights during non-peak hours to further increase utilisation rate. The Literature review in section 3.2.12 suggested that the pricing model needs to attract new customers to business aviation and compete with airline competitors and substitutes. This pricing model could potentially fulfil both requirements.

Conclusion: Introduced an operational and pricing model that solves the cash flow problem, adjusts for demand and enables customers to share the flight costs.

Industry experts were asked in a survey to choose three out of ten theory driven practices they consider most viable for boosting revenue in charter operations with the PC-12 aircraft. Alternatives were as following:

- Use traditional yield management;
- Introduce an innovative pricing model;
- Increase the seat load factor;
- Increase average route length;
- Optimise routes based on demand;
- Add new sales channels;
- Increase marketing budget;
- Introduce a customer loyalty programme;
- Enter a strategic partnership;
- Other (specify).

Eight out of ten (80%) interviewees consider that entering a strategic partnership belongs to the top three practices for boosting revenue. Respectively, six out of ten (60%) consider introducing an innovative pricing model to be effective. Five out of ten (50%) answered that they recommend optimising routes based on demand and add new sales channels. Three out of ten (30%) would use traditional yield management techniques like dynamic pricing as a source of new revenue. Individual votes (10%) were given to increase the seat load factor, to execute flights based on demand ("other") and to increase presence in multiple bases ("other"). Rest of the alternatives gathered no support from experts answering interview questions. The three alternatives that gathered most votes are considered significant. Detailed survey results are found in Appendix A question 5.

Conclusion: Enter a strategic partnership, introduce an innovative pricing model and optimise routes based on demand to boost revenue.

4.10 Summary of Results

The resulting business model developed in this chapter is presented below. Results are arranged based on the used “business model canvas” framework designed by Osterwalder and Pigneur (2010).

Key Partners

Research question: which functions to outsource?

Thesis research suggests to outsource maintenance and ground handling while functions that should be done in-house include; operational planning/control, quality control and employee recruitment. Research did not give enough evidenence to decide on other air operator functions.

Key Activities

Research questions: what route length and route structure to utilize? what airport base and region to operate in? what type of operations to conduct and with what fleet size?

Research suggests the optimum route length with the PC-12 aircraft ranges from 200 Nm to 500 Nm and that a point-to-point route network is ideal unless cooperating with large airlines in a hub-and-spoke system. Other findings recommend choosing easily accessible, less congested secondary/regional airports with a high situational demand as base. Operate in wealthy countries and regions with a high density of population, small airports and rural industries like France, Germany, UK and Switzerland. Aim at high and achievable annual aircraft utilisation rates around 1200 flight hours per aircraft in on-demand charter and around 2000 hours in scheduled operations. Scheduled operations should utilize a minimum of three aircraft and increase utilization rates by feeding airlines and/or offer on-demand flights during non-peak hours.

Value Proposition

Research question: what should be the main value propositions?

Findings suggest that the most important customer value propositions in PC-12 operations are saved travel time, flexible schedules, hassle-free travel at less congested airports and the ability to use airports that airlines don’t serve.

Customer Relationship

Research question: how should you interact with customers?

Enough support on how to interact with customers was not found in thesis research to draw conclusions.

Customer Segment

Research question: which customer segment to target?

Research suggests targeting the business for corporate travellers, wealthy leisure travellers, government entities, medical evacuation clients and travellers currently using first and business class services on airline flights. Additionally, scheduled PC-12 flights should be targeted for individuals with above average income, but not the super wealthy.

Key Resources

Research question: what are the key resources?

Interview findings show the key resources for successful PC-12 operations are availability of maintenance, experienced pilots, the right employees and the right business model.

Distribution Channel

Research question: what are the best sales and marketing channels?

Research support the use of online sales and marketing channels and suggests utilizing mobile applications to manage bookings and track demand

Cost Structure

Research question: what do planned operations cost and how to cut cost?

Estimates of operating costs are given in section 4.8. Research suggests increasing aircraft utilization rate, avoid empty legs, increase fleet size and use airports with lower landing and handling fees to cut unit cost.

Revenue Stream

Research question: what are the revenue streams and how can they be increased?

Estimates of revenue streams are given in section 4.9. Research suggests entering a strategic partnership, introduce an innovative pricing model and optimise routes based on demand to boost revenue.

5 Result and Research Evaluation

5.1 Result Evaluation

Literature presents many frameworks to evaluate a ready-made business model. One way of assessing the attractiveness of the proposed business model is the well-known *Porter's Five Force Framework*. The framework developed by Michael Porter assumes five competitive forces act in any business situation, namely; "the threat of substitutes, the bargaining power of suppliers, the threat of new entrants, the bargaining power of buyers and industry rivalry" (Porter, 2008: 28).

The below assessment is inspired by an IATA (2011) report produced with the assistance of professor Michael Porter offering insight on global competitiveness of the airline market. Each competitive force evaluation is based on thesis findings:

Threat of Substitutes (Medium)

- Alternative ground transport (e.g. high speed trains) pose a threat for short distances air travel;
- Technologies for online conferences gain popularity amongst the targeted customer segment; and
- Number of customers affording business aviation increases with a cost-effective single engine aircraft lowering the threat of substitutes.

Bargaining Power of Suppliers (High)

- Aircraft and engine manufacturer predetermined in the business model;
- Airport services concentrated to few providers at small regional airports; and
- Airports represent a monopolistic market structure.

Threat of New Entrants (Medium)

- Specialised workforce needed to enter niche market;
- High market barriers for aircraft financing;
- Relatively easy to access distribution channels; and
- Limited advantages for established businesses.

Bargaining power of Buyers (Medium)

- Online sales increase price sensitivity;
- Price sensitivity due to comparable offerings from rival airlines;
- Business aviation perceived as a luxury product; and
- Low switching barriers for customers.

Industry Rivalry (High)

- Relatively low product differentiation;
- High fixed costs and low variable costs; and
- Substantial exit barriers.

Reference source: IATA (2011)

Refer to chapter 2 for more information on the competitive scene of the business aviation sector. Porter's five force evaluation reveals that all competitive forces are medium or high for the suggested air transport business model, which should be considered in business planning.

5.2 Research Evaluation

Research is often evaluated based on its reliability and validity. Reliability is the degree to which a measurement can be perceived accurate and whether same results are obtained by measuring it again. Validity is the extent to which a measurement corresponds to the real world and whether the measurement measures the right concept. (Liu et al., 2017). There are many aspects affecting the reliability and validity of research findings, some of which are reviewed below.

The overall validity of interview and survey responses is considered high due to respondent's experience and top expertise in business aviation. Validity of the research is slightly lowered by the selection process of respondents. All twelve interviewees belong to a network of Hendell Aviation's partners and contacts. This group may be biased as persons within the industry often have a positive view of the subject and because answers may be influenced by group opinion when interviewees link together. The main disadvantage of interview research is that the reliability is a concern due to risk of misinterpretation and a chance exists that wrong aspects of the data are focused on. However, the transparent method of referring to interviewees by their real names makes it easier for the reader to assess and verify the reliability and truthfulness of the claims. This method is not common in academic research when referring to interview data and is a strength of this thesis. Finally, using historical data to predict the future is unreliable and some of the predictions may never realise.

The reliability and validity of each sub-category is discussed below:

Key partner research leaning on quantitative survey analysis signalled some significant results, however, the low number of survey respondents makes it hard to justify reliability. *Value proposition* and *key activity* analysis in terms of route length findings are considered valid and reliable as theory was confirmed with survey and interview findings signalling a high significance. The validity of route structure and type of operation research is lower as individual findings may be invalid due to interviewee preconception and bias. Fleet size, *customer segment* and *distribution channel* studies are all affected by a low number of individual interview responses lowering result reliability and validity. As reported in section 4.4, the high uncertainty of data made it impossible to draw any conclusion concerning the *customer relationship* study. *Key resource* findings are considered reliable due to a high amount of similar and independent interview answers. Validity of qualitative *cost structure* and *revenue stream* analysis is low as interview answers used for analysis bases on estimates. The amount of survey respondents is low to make reliable and valid conclusion on how to cut cost or boost revenue.

6 Discussion

This thesis presented and analysed literature, interviews and a survey to develop a business model for commercial operations of PC-12 aircraft in Europe. All sub-questions derived from the “business model canvas” framework were covered and significant findings were emphasized in the research. In parallel with answering questions concerning the business model, this thesis questioned whether commercial operations with PC-12 aircraft can be profitable in Europe. Interviewee opinion indicates this aircraft could provide a cost advantage against existing air travel business models in Europe. Simple cost and revenue analysis supports this conclusion. However, the financial models did not correct for the present value of the initial investment or account for sales and marketing expenses.

The business model development applied in this thesis used a comprehensive method that started with market analysis and selection of a suitable business model framework. The framework was reflected with industry specific literature and knowledge to place it in an industry specific context. Finally, interview and survey findings were used to find the optimum solutions and position the possible offering in the European market. This robust approach is unique to the industry and a similar approach could be beneficial for anyone conducting business model development or analysis.

Several other aspects induced limitations to the study. One problem is comparing results of inconsistent questions as questions are asked in different ways from different interviewees. Interview answers are prone to be weighted or prioritised differently by the interviewer which impacts results. There also exists a tendency of interviewees to provide answers the interviewee wants to hear. The interviewee may also be familiar with the question asked and might provide an answer not based on real perception but instead on earlier invalid or inaccurate sources. The interview process itself, including structure, timing, location and fatigue etc., may impact research findings. Suggested solutions may not work well together as operational decisions were studied separately. Another limitation of the study is that no real operational data is used to validate or test the business model. Survey findings were problematic to use as a sample of ten respondents is small for making quantitative conclusions. Therefore, many survey questions were designed to be analysed with qualitative techniques. Other general limitations of surveys are that respondents may not feel encouraged to provide accurate answers, the few close-ended questions have a lower validity rate and certain options may be interpreted differently. Also, those respondents that answered the survey may share different opinions compared to those who chose not to. Fortunately, the response rate was high, which increases survey reliability.

To further enhance this research more business model related questions could be analysed and different frameworks applied. The accuracy of the research could be increased with a larger group of interviewees and more respondents to survey questions. To solve issues with interview and survey research it is recommended that further research would focus on testing the phenomenon in real-life and use methods of observational research to verify findings. It would be interesting to study how the different elements of the proposed business model interacts in real world air operations.

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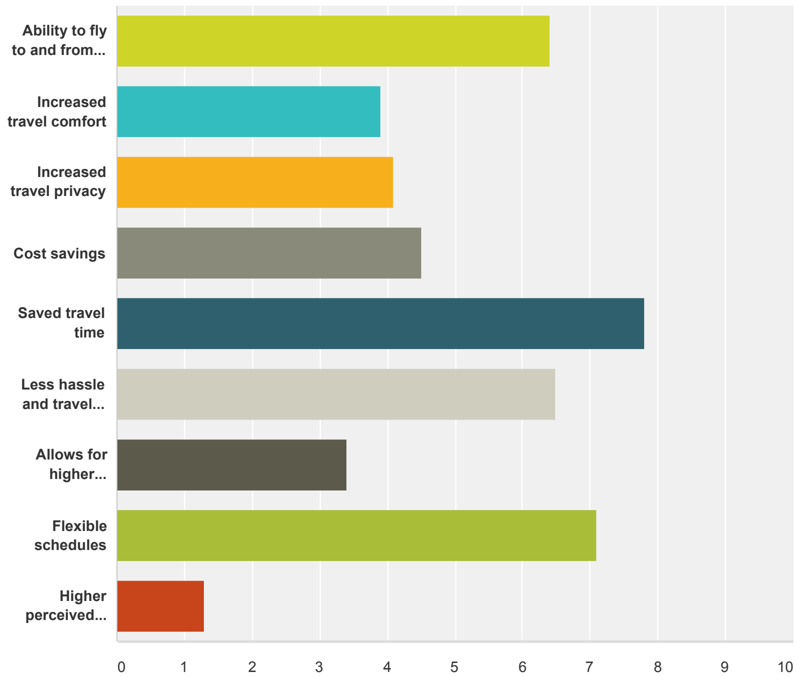
Appendix A – Survey Responses

Q1 What do you think customers value most when using Pilatus PC-12 aircraft for traveling? Sort the following benefits from the highest to the lowest customer perceived value, number 1 being the benefit that you consider customers value the most.

Answered: 10 Skipped: 0

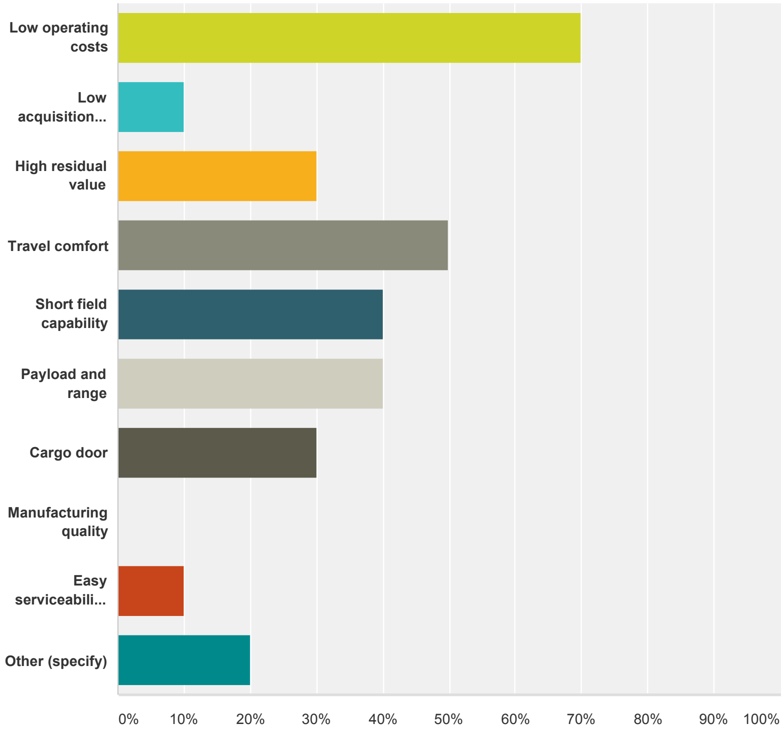


	1	2	3	4	5	6	7	8	9	N/A	Total	Score
Ability to fly to and from airports not served by other commercial alternatives	10.00% 1	20.00% 2	40.00% 4	10.00% 1	0.00% 0	0.00% 0	10.00% 1	10.00% 1	0.00% 0	0.00% 0	10	6.40
Increased travel comfort	0.00% 0	0.00% 0	0.00% 0	0.00% 0	40.00% 4	20.00% 2	30.00% 3	10.00% 1	0.00% 0	0.00% 0	10	3.90
Increased travel privacy	0.00% 0	0.00% 0	0.00% 0	20.00% 2	30.00% 3	20.00% 2	10.00% 1	10.00% 1	10.00% 1	0.00% 0	10	4.10
Cost savings	10.00% 1	0.00% 0	10.00% 1	10.00% 1	10.00% 1	30.00% 3	10.00% 1	10.00% 1	10.00% 1	0.00% 0	10	4.50
Saved travel time	40.00% 4	30.00% 3	10.00% 1	10.00% 1	10.00% 1	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	10	7.80
Less hassle and travel delays at congested airports	20.00% 2	10.00% 1	20.00% 2	30.00% 3	0.00% 0	10.00% 1	10.00% 1	0.00% 0	0.00% 0	0.00% 0	10	6.50

Allows for higher productivity during travel	**0.00%** 0	**0.00%** 0	**10.00%** 1	**0.00%** 0	**10.00%** 1	**20.00%** 2	**20.00%** 2	**40.00%** 4	**0.00%** 0	**0.00%** 0	10	3.40
Flexible schedules	**20.00%** 2	**40.00%** 4	**10.00%** 1	**20.00%** 2	**0.00%** 0	**0.00%** 0	**0.00%** 0	**10.00%** 1	**0.00%** 0	**0.00%** 0	10	7.10
Higher perceived safety and security	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	**0.00%** 0	**10.00%** 1	**10.00%** 1	**80.00%** 8	**0.00%** 0	10	1.30

Q2 Choose the top 3 strengths that you consider the Pilatus PC-12 offers against its rivals.

Answered: 10 Skipped: 0



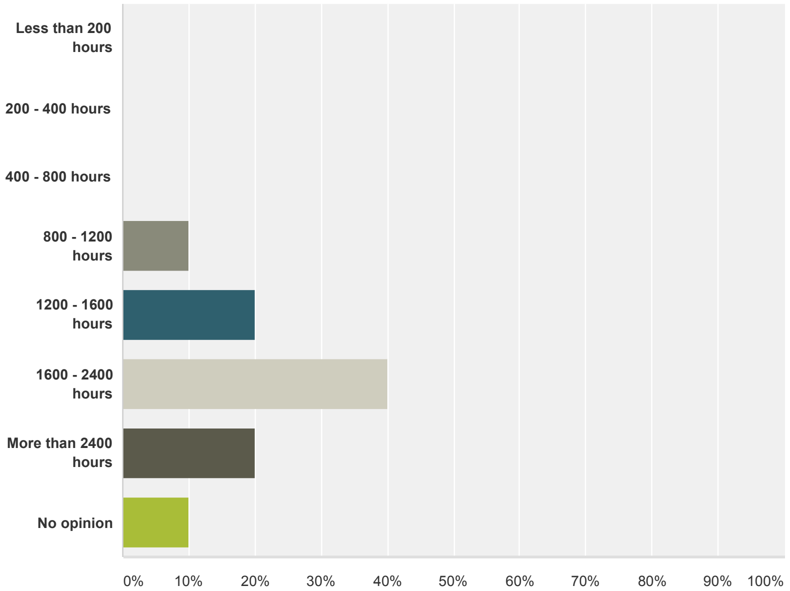
Answer Choices	Responses	
Low operating costs	**70.00%**	7
Low acquisition cost	**10.00%**	1
High residual value	**30.00%**	3
Travel comfort	**50.00%**	5
Short field capability	**40.00%**	4
Payload and range	**40.00%**	4
Cargo door	**30.00%**	3

Manufacturing quality	**0.00%**	0
Easy serviceability and maintenance	**10.00%**	1
Other (specify)	**20.00%**	2
Total Respondents: 10		

#	Other (specify)	Date
1	Transformability	12/2/2016 12:25 AM
2	Cost per NM per seat	11/6/2016 1:21 PM

Q3 What do you consider as the highest operationally achievable yearly utilization rate for AOC operations with the Pilatus PC-12 without taking demand into consideration?

Answered: 10 Skipped: 0

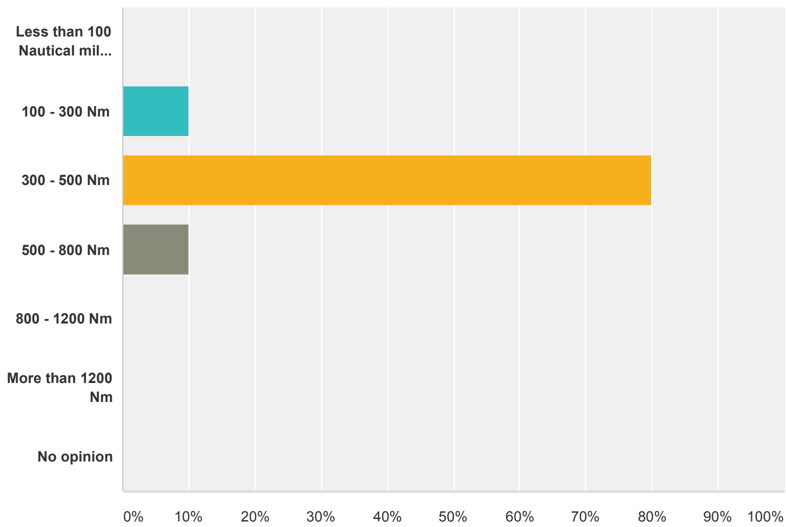


Answer Choices	Responses	
Less than 200 hours	**0.00%**	0
200 - 400 hours	**0.00%**	0
400 - 800 hours	**0.00%**	0
800 - 1200 hours	**10.00%**	1
1200 - 1600 hours	**20.00%**	2
1600 - 2400 hours	**40.00%**	4
More than 2400 hours	**20.00%**	2

No opinion	10.00%	1
Total		**10**

Q4 What do you consider as the most competitive air travel distance for the Pilatus PC-12 aircraft?

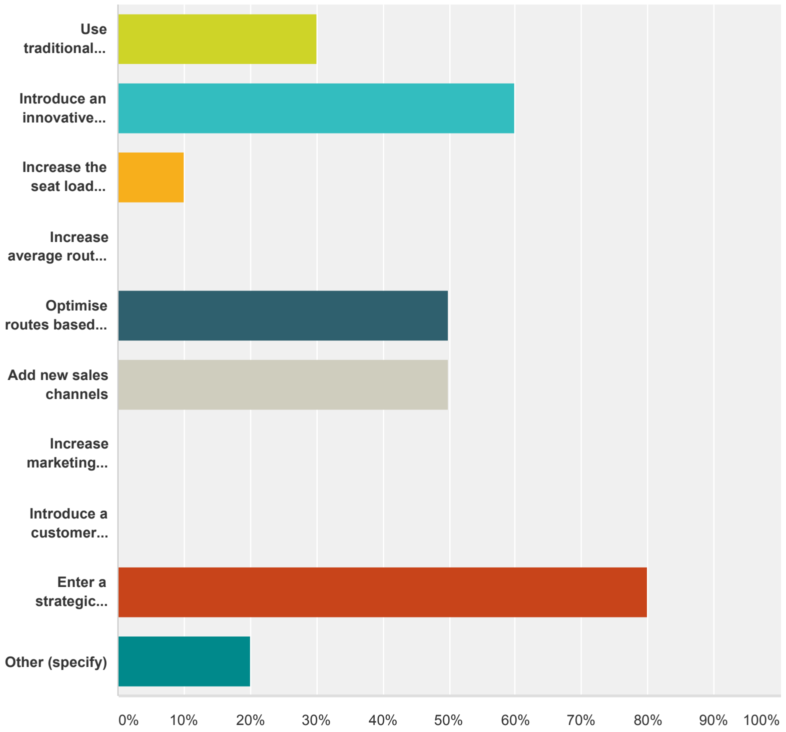
Answered: 10   Skipped: 0



Answer Choices	Responses	
Less than 100 Nautical miles (Nm)	0.00%	0
100 - 300 Nm	10.00%	1
300 - 500 Nm	80.00%	8
500 - 800 Nm	10.00%	1
800 - 1200 Nm	0.00%	0
More than 1200 Nm	0.00%	0
No opinion	0.00%	0
Total		**10**

Q5 Choose the top 3 practices you consider most cost effective for boosting revenue in charter or air taxi operations with the Pilatus PC-12 aircraft.

Answered: 10   Skipped: 0



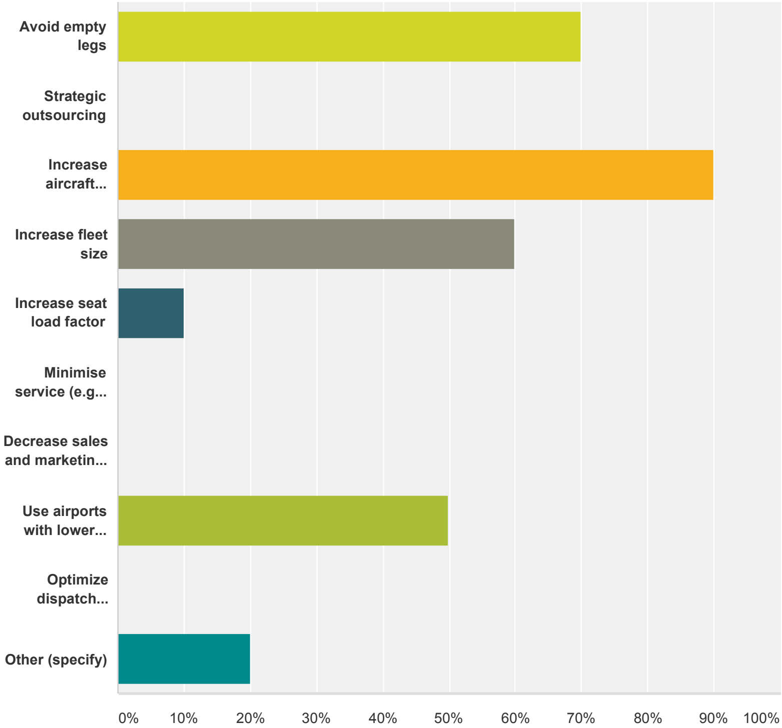
Answer Choices	Responses	
Use traditional yield management (e.g. dynamic pricing based on demand, time of booking and customer segment)	**30.00%**	3
Introduce an innovative pricing model	**60.00%**	6
Increase the seat load factor	**10.00%**	1
Increase average route length	**0.00%**	0
Optimise routes based on demand	**50.00%**	5
Add new sales channels	**50.00%**	5
Increase marketing budget	**0.00%**	0
Introduce a customer loyalty programme	**0.00%**	0
Enter a strategic partnership	**80.00%**	8
Other (specify)	**20.00%**	2
Total Respondents: 10		

#	Other (specify)	Date
1	Aircraft On Demand (lento toteutuu, jos tarpeeksi kiinnostuneita)	12/18/2016 5:44 PM
2	Increase presence in multiple bases	11/10/2016 3:29 PM

Q6 Choose the top 3 practices you consider most viable for reducing unit costs in

charter or air taxi operations with the Pilatus PC-12 aircraft.

Answered: 10   Skipped: 0

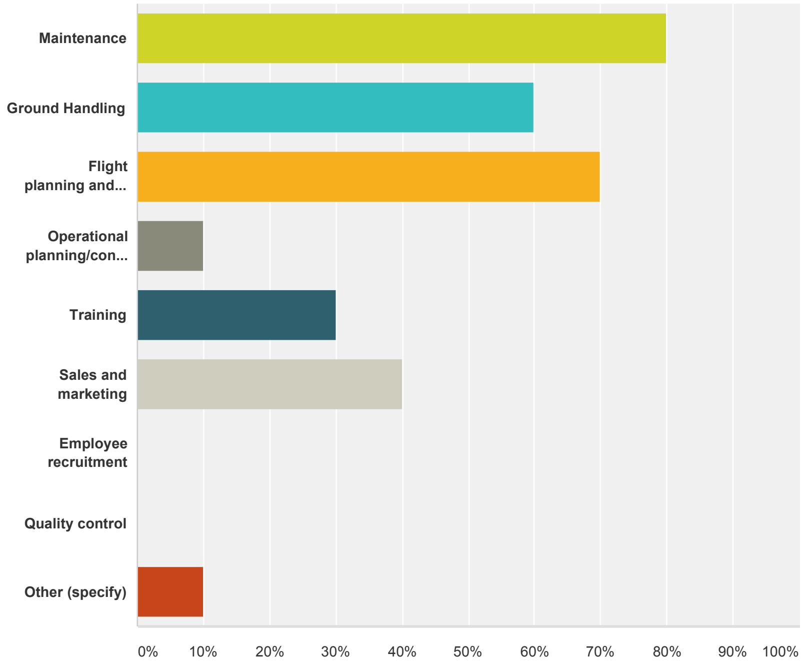


Answer Choices	Responses	
Avoid empty legs	**70.00%**	7
Strategic outsourcing	**0.00%**	0
Increase aircraft utilisation rates	**90.00%**	9
Increase fleet size	**60.00%**	6
Increase seat load factor	**10.00%**	1
Minimise service (e.g. customer meals and on-board entertainment)	**0.00%**	0
Decrease sales and marketing budget	**0.00%**	0
Use airports with lower landing and handling fees	**50.00%**	5
Optimize dispatch process	**0.00%**	0
Other (specify)	**20.00%**	2
Total Respondents: 10		

#	Other (specify)	Date
1	Aircraft utilisation agreements with low usage private owners	12/18/2016 5:44 PM
2	fly legs between airports with bi-directional traffic	11/26/2016 6:47 AM

Q7 Choose three functions you find most beneficial to outsource in Pilatus PC-12 operations from a cost reduction perspective.

Answered: 10 Skipped: 0



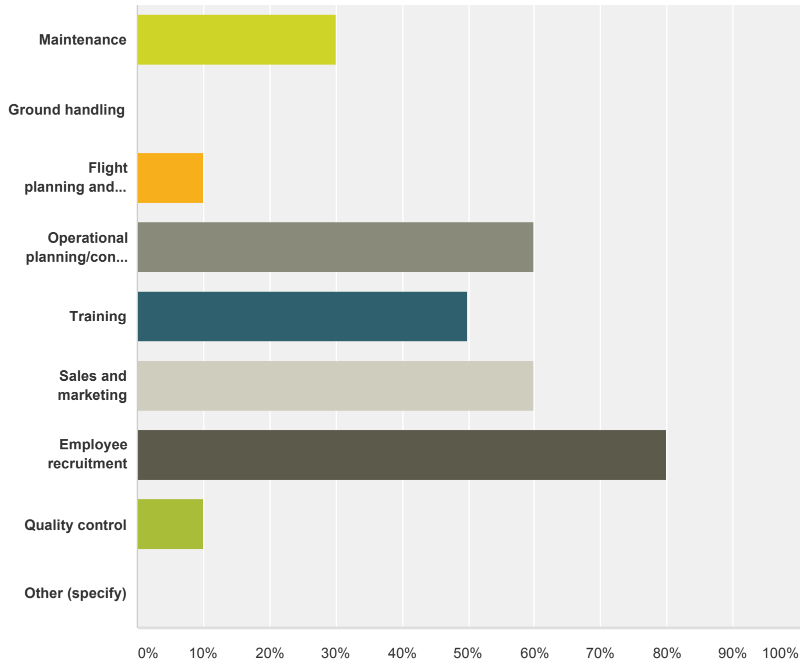
Answer Choices	Responses	
Maintenance	80.00%	8
Ground Handling	60.00%	6
Flight planning and dispatch	70.00%	7
Operational planning/control (e.g. scheduling, crew control etc.)	10.00%	1
Training	30.00%	3
Sales and marketing	40.00%	4
Employee recruitment	0.00%	0
Quality control	0.00%	0
Other (specify)	10.00%	1
Total Respondents: 10		

#	Other (specify)	Date
1	Maintenance if fleet under 6 aircraft	11/10/2016 3:32 PM

Q8 Choose three functions you consider

have the highest strategic importance in Pilatus PC-12 operations.

Answered: 10 Skipped: 0

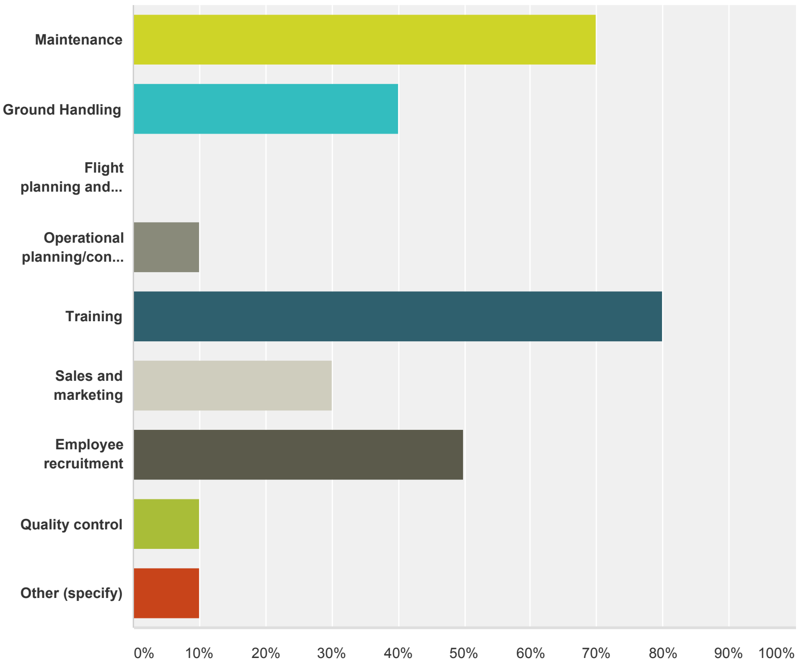


Answer Choices	Responses	
Maintenance	**30.00%**	3
Ground handling	**0.00%**	0
Flight planning and dispatch	**10.00%**	1
Operational planning/control (e.g. scheduling, crew control etc.)	**60.00%**	6
Training	**50.00%**	5
Sales and marketing	**60.00%**	6
Employee recruitment	**80.00%**	8
Quality control	**10.00%**	1
Other (specify)	**0.00%**	0
Total Respondents: 10		

#	Other (specify)	Date
	There are no responses.	

Q9 Choose three functions you consider requires most resources and capital in PC-12 operations.

Answered: 10   Skipped: 0

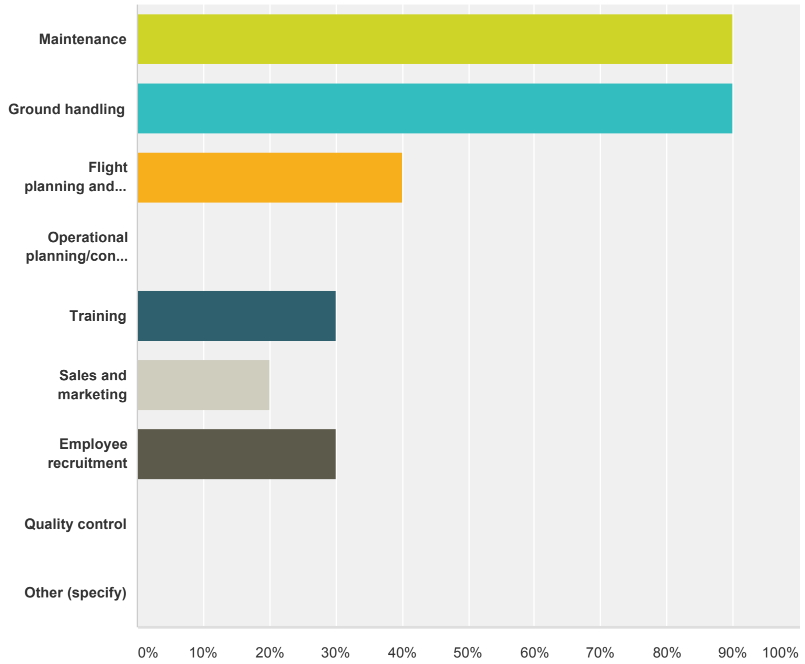


Answer Choices	Responses	
Maintenance	**70.00%**	7
Ground Handling	**40.00%**	4
Flight planning and dispatch	**0.00%**	0
Operational planning/control (e.g. scheduling, crew control etc.)	**10.00%**	1
Training	**80.00%**	8
Sales and marketing	**30.00%**	3
Employee recruitment	**50.00%**	5
Quality control	**10.00%**	1
Other (specify)	**10.00%**	1
Total Respondents: 10		

#	Other (specify)	Date
1	Aircraft cost of capital	11/26/2016 6:50 AM

Q10 Choose three functions you consider easiest to outsource in Pilatus PC-12 operations.

Answered: 10   Skipped: 0



Answer Choices	Responses	
Maintenance	**90.00%**	9
Ground handling	**90.00%**	9
Flight planning and dispatch	**40.00%**	4
Operational planning/control (e.g. scheduling, crew control etc.)	**0.00%**	0
Training	**30.00%**	3
Sales and marketing	**20.00%**	2
Employee recruitment	**30.00%**	3
Quality control	**0.00%**	0
Other (specify)	**0.00%**	0
Total Respondents: 10		

#	Other (specify)	Date
	There are no responses.	